Project Manual

High School DDD

prepared for:

St. Lucie Public Schools

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PHASE III CONSTRUCTION DOCUMENTS

Volume 1 of 2

- Divisions 00 thru 14

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ST. LUCIE PUBLIC SCHOOLS
HIGH SCHOOL DDD
PHASE III CONSTRUCTION DOCUMENTS

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PROCUREMENT AND CONTRACTING
REQUIREMENTS GROUP

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SECTION 00 00 40
STATEMENT OF COMPLIANCE

To the best of my knowledge the Plans and Specifications comply with the applicable minimum building codes and the applicable fire-safety standards as determined by the local authority in accordance with this section and 633 Florida Statutes.

END OF SECTION 00 00 40

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SECTION 00 05 00
NON-ASBESTOS STATEMENT

To the best of my knowledge these Contract Documents do not contain any asbestos containing materials intended for use in construction.

END OF SECTION 00 05 00

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DOCUMENT 00 31 32
GEOTECHNICAL DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.

B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.

C. A geotechnical investigation report for Project, is available for viewing at the office of the Owner.

1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 00 31 32

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Division 01

General Requirements

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SECTION 01 09 00
GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

B. Related Sections:

1. Division 22 Section "PLUMBING COMMISSIONING REQUIREMENTS" for commissioning process activities for plumbing systems, assemblies, equipment, and components.
2. Division 23 Section "HVAC COMMISSIONING" for commissioning process activities for HVAC&R systems, assemblies, equipment, and components.
3. Division 26 Section "ELECTRICAL COMMISSIONING" for commissioning process activities for electrical systems, assemblies, equipment, and components.

1.2 DEFINITIONS

A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

C. CxA: Commissioning Authority.

D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.3 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.4 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and Contractor for information and use. CxA will assist owner in the creation of OPR if needed.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
3. Attend commissioning team meetings held on a monthly basis until 20% of equipment has
been started or is ready to start. Meetings will be bi-weekly from that point on.
4. Integrate and coordinate commissioning process activities with construction schedule.
5. Complete electronic construction checklists as Work is completed and provide to the Commissioning Authority on a weekly basis.
6. Review and accept commissioning process test procedures provided by the Commissioning Authority.
7. Complete commissioning process test procedures.

1.6 CxA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Provide commissioning plan.

C. Convene commissioning team meetings.

D. Provide Project-specific construction checklists and commissioning process test procedures.

E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data,

tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

F. Prepare and maintain the Issues Log.

G. Prepare and maintain completed construction checklist log.

H. Witness systems, assemblies, equipment, and component startup.

I. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

END OF SECTION 01 90 00

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SECTION 01 10 00
SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work performed by Owner.
5. Multiple Work Packages.
6. Work under Owner's separate contracts.
7. Owner's product purchase contracts.
8. Owner-furnished/Contractor-installed (OFCI) products.
9. Contractor's use of site and premises.
10. Work restrictions.
11. Specification and Drawing conventions.

1.3 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.4 PROJECT INFORMATION

A. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.

1.5 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.6 PHASED CONSTRUCTION

A. Construct the Work in phases, with each phase substantially complete as indicated.

B. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule, showing the sequence, commencement and completion dates for all phases of the Work.

1.7 WORK PERFORMED BY OWNER

A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.8 WORK UNDER OWNER'S SEPARATE CONTRACTS

A. Work with Separate Contractors: Cooperate fully with Owner's separate contractors, so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under Owner's separate contracts.

1.9 OWNER'S PRODUCT PURCHASE CONTRACTS

A. Owner has negotiated Product Purchase contracts with suppliers of material and equipment to be incorporated into the Work. Owner will assign these Product Purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum unless otherwise indicated.

1. Contractor's responsibilities are same as if Contractor had negotiated Product Purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.

1.10 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:

1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
2. Provide for delivery of Owner-furnished products to Project site.
3. Upon delivery, inspect, with Contractor present, delivered items.

    a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.

4. Obtain manufacturer's inspections, service, and warranties.
5. Inform Contractor of earliest available delivery date for Owner-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
3. Receive, unload, handle, store, protect, and install Owner-furnished products.
4. Make building services connections for Owner-furnished products.
5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
6. Repair or replace Owner-furnished products damaged following receipt.

C. Owner-Furnished/Contractor-Installed (OFCI) Products:

1. As indicated on the drawings.

1.11 CONTRACTOR'S USE OF SITE AND PREMISES

A. Limits on Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.12 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to between 7:00 a.m. to 7:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

1. Weekend Hours: No restrictions. the work hours to be coordinated with owner.
2. Early Morning Hours: No restrictions. the work hours to be coordinated with owner.

C. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Project site is not permitted.

D. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

E. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.13 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form that is part of web-based Project management software.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

    a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    b. Substitution request is fully documented and properly submitted.
    c. Requested substitution will not adversely affect Contractor's construction schedule.
    d. Requested substitution has received necessary approvals of authorities having jurisdiction.
    e. Requested substitution is compatible with other portions of the Work.
    f. Requested substitution has been coordinated with other portions of the Work.
    g. Requested substitution provides specified warranty.
    h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

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SUBSTITUTION REQUEST FORM

REQUEST FOR SUBSTITUTION

PROJECT:_____ DATE:_____

SPECIFICATION SECTION:_____ ITEM(S):_____

SPECIFIED MANUFACTURER:_____

SPECIFIED MODEL NO:_____

PROPOSED MANUFACTURER:_____

PROPOSED MODEL NO:_____

REASON/S FOR SUBSTITUTION_____

_____

Attach complete technical data, including laboratory tests, if applicable, in duplicate.

A. Will approval affect dimensions shown on Drawings in any way? No_____ Yes_____
Explain (Attach drawings if necessary):_____
_____
_____

B. Will approval affect dimensions shown on Drawings in any way? No_____ Yes_____
Explain (Attach drawings if necessary):_____
_____
_____

C. Will the Contractor pay for any changes to the building design, including engineering and detailing costs caused by the approval? No_____ Yes_____
Explain:_____
_____

D. Will approval affect the work of other trades? No_____ Yes_____
Explain:_____
_____

E. Manufacturer's guarantees of the proposed and specified items are: Same_Different_____
Explain:_____
_____

F. Does the proposed item meet all applicable Codes, Ordinances and regulations for this specific application? No_____Yes_____
Explain:_____

G. Has proposed item been used locally in similar applications? No_____Yes_____
Explain:_____

H. Does the proposed alternate material meet the same applicable standards (ASTM, ANSI, UL, FS.) as the specified item? No_____Yes_____
Explain:_____

I. Has the line-by-line comparison been included? No_____Yes_____
Explain_____

J. If approved, how much credit will the Owner receive for the proposed alternate material?

Credit Value_____
Explain:_____

Provide all information necessary to determine the proposed alternate material is equal or better than the specified item. This includes any test reports, product data, manufacturer's specifications, color samples, product samples or the like as may be required for an evaluation.

The Architect will not be required to prove any product is not equal or suitable to the Project.

Signature shall be by person having authority to legally bind their firm to the above terms. Failure to provide legally binding signature will result in retraction of approval.

SUBMITTED BY: _____

Firm: _____

Address: _____

_____

Signature:_____ Date:_____

FOR ARCHITECT'S USE:

Not Acceptable _____

No Exceptions Taken _____

By:_____ Date:_____

END OF SECTION 01 60 20

SECTION 01 26 00
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue through Construction Manager supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on web-based Project management software.

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Construction Manager will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Construction Manager are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
e. Quotation Form: Use form provided as part of web-based Project management software.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Construction Manager.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form provided as part of web-based Project management software.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Construction Manager will issue a Change Order for signatures of Owner and Contractor on form provided as part of web-based Project management software.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect or Construction Manager may issue a Construction Change Directive on form provided as part of web-based Project management software. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

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SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.

1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to Architect through Construction Manager at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract, as described in Section 01 10 00 "Summary."

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Owner's name.
c. Owner's Project number.
d. Name of Architect.
e. Architect's Project number.
f. Contractor's name and address.
g. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

    a. Related Specification Section or division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.

        1) Labor.
        2) Materials.
        3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site.

6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
7. Purchase Contracts: Provide a separate line item in the schedule of values for each Purchase contract. Show line-item value of Purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
8. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
9. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
10. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
11. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
12. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and Construction Manager and paid for by Owner.

B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

1. Other Application for Payment forms proposed by the Contractor may be acceptable to Architect, Construction Manager and Owner. Submit forms for approval with initial submittal of schedule of values.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Schedule of unit prices.
7. Submittal schedule (preliminary if not final).
8. List of Contractor's staff assignments.
9. List of Contractor's principal consultants.
10. Copies of building permits.
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
12. Initial progress report.
13. Report of preconstruction conference.
14. Certificates of insurance and insurance policies.
15. Performance and payment bonds.
16. Data needed to acquire Owner's insurance.

I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 01 77 00 "Closeout Procedures."

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.

3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. AIA Document G706.
6. AIA Document G706A.
7. AIA Document G707.
8. Evidence that claims have been settled.
9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
10. Final liquidated damages settlement statement.
11. Proof that taxes, fees, and similar obligations are paid.
12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

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SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Web-based Project management software package.
6. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

1.3 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in built facility. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to coordination drawingsin a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

    a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
    d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:

a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00 "Submittal Procedures."

C. Coordination Drawing Process: Prepare coordination drawings in the following manner:

1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.
6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
7. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.

D. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format:

a. Same digital data software program, version, and operating system as original Drawings.
b. RVT., Version 2021, operating in Microsoft Windows operating system.

2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format.
3. BIM File Incorporation: Construction Manager will incorporate Contractor's coordination drawing files into BIM established for Project.

a. Construction Manager will perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.

4. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

b. Digital Data Software Program: Drawings are available in Revit V2021, WIndows.
c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

1.7 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Owner name.
3. Owner's Project number.
4. Name of Architect and Construction Manager.
5. Architect's Project number.
6. Date.
7. Name of Contractor.
8. RFI number, numbered sequentially.
9. RFI subject.
10. Specification Section number and title and related paragraphs, as appropriate.
11. Drawing number and detail references, as appropriate.
12. Field dimensions and conditions, as appropriate.
13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
14. Contractor's signature.
15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.

1. Attachments shall be electronic files in PDF format.

D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for approval of Contractor's means and methods.
   d. Requests for coordination information already indicated in the Contract Documents.
   e. Requests for adjustments in the Contract Time or the Contract Sum.
   f. Requests for interpretation of Architect's actions on submittals.
   g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect or Construction Manager of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."

   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 5 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web-based Project management software. Software log with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect and Construction Manager.
4. RFI number, including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's and Construction Manager's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven days if Contractor disagrees with response.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model CAD drawings will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in Revit V2021 Windows.
4. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

    a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.

5. The following digital data files will be furnished for each appropriate discipline:

    a. Floor plans.
    b. Reflected ceiling plans.

B. Web-Based Project Management Software Package: Provide, administer, and use web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.

1. Web-based Project management software includes, at a minimum, the following features:

    a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    c. Document workflow planning, allowing customization of workflow between project entities.
    d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
    e. Track status of each Project communication in real time, and log time and date when responses are provided.
    f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
    g. Processing and tracking of payment applications.
    h. Processing and tracking of contract modifications.
    i. Creating and distributing meeting minutes.
    j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
    k. Management of construction progress photographs.
    l. Mobile device compatibility, including smartphones and tablets.

2. Provide up to seven Project management software user licenses for use of Owner, Construction Manager, Architect, and Architect's consultants. Provide eight hours of software training at Architect's office for web-based Project software users.
3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 PROJECT MEETINGS

A. General: Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Architect, within three days of the meeting.

B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Responsibilities and personnel assignments.
    b. Tentative construction schedule.
    c. Phasing.
    d. Critical work sequencing and long lead items.
    e. Designation of key personnel and their duties.
    f. Lines of communications.
    g. Use of web-based Project software.
    h. Procedures for processing field decisions and Change Orders.
    i. Procedures for RFIs.
    j. Procedures for testing and inspecting.
    k. Procedures for processing Applications for Payment.
    l. Distribution of the Contract Documents.
    m. Submittal procedures.
    n. Preparation of Record Documents.
    o. Use of the premises.
    p. Work restrictions.
    q. Working hours.
    r. Responsibility for temporary facilities and controls.
    s. Procedures for moisture and mold control.
    t. Procedures for disruptions and shutdowns.
    u. Construction waste management and recycling.
    v. Parking availability.
    w. Office, work, and storage areas.
    x. Equipment deliveries and priorities.

y. First aid.
z. Security.
aa. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Construction Manager will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

    a. Preparation of Record Documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Procedures for completing and archiving web-based Project software site data files.
    d. Submittal of written warranties.
    e. Requirements for preparing operations and maintenance data.
    f. Requirements for delivery of material samples, attic stock, and spare parts.
    g. Requirements for demonstration and training.
    h. Preparation of Contractor's punch list.
    i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    j. Submittal procedures.
    k. Coordination of separate contracts.
    l. Installation of Owner's furniture, fixtures, and equipment.
    m. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Construction Manager will conduct progress meetings at weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Resolution of BIM component conflicts.
4) Status of submittals.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site use.
9) Temporary facilities and controls.
10) Progress cleaning.
11) Quality and work standards.
12) Status of correction of deficient items.
13) Field observations.
14) Status of RFIs.
15) Status of Proposal Requests.
16) Pending changes.
17) Status of Change Orders.
18) Pending claims and disputes.
19) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Construction Manager will conduct Project coordination meetings at monthly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.

c. Review present and future needs of each contractor present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Resolution of BIM component conflicts.
4) Status of submittals.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site use.
9) Temporary facilities and controls.
10) Work hours.
11) Hazards and risks.
12) Progress cleaning.
13) Quality and work standards.
14) Status of RFIs.
15) Proposal Requests.
16) Change Orders.
17) Pending changes.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's Construction Schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Unusual event reports.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file.
2. PDF file.

B. Startup construction schedule.

1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
3. Total Float Report: List of activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work or the Notice to Proceed as defined in the General Conditions of Construction until most recent Application for Payment.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit at monthly intervals.

H. Material Location Reports: Submit at monthly intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Unusual Event Reports: Submit at time of unusual event.

K. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including phasing and interim milestones.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

1. Use scheduling component of Project management software package specified in Section 01 31 00 "Project Management and Coordination," for current Windows operating system.

B. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting, using CPM scheduling.

1. In-House Option: Owner may waive requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

C. Time Frame: Extend schedule from date established for commencement of the Work, the Notice of Award or the Notice to Proceed as defined in the General Condition for Construction to date of Substantial Completion or Final Completion as defined in the General Condition for Construction.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

D. Activities: Treat each separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Temporary Facilities: Indicate start and completion dates for the following as applicable:

    a. Securing of approvals and permits required for performance of the Work.
    b. Temporary facilities.
    c. Construction of mock-ups, prototypes and samples.
    d. Owner interfaces and furnishing of items.
    e. Interfaces with Separate Contracts.
    f. Regulatory agency approvals.
    g. Punch list.

3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
4. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
6. Commissioning Time: Include no fewer than 15 days for commissioning.
7. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
8. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.

E. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.

4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. Work Restrictions: Show the effect of the following items on the schedule:

    a. Uninterruptible services.
    b. Use-of-premises restrictions.
    c. Provisions for future construction.
    d. Seasonal variations.
    e. Environmental control.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Building flush-out.
    m. Startup and placement into final use and operation.
    n. Commissioning.

8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Structural completion.
    b. Temporary enclosure and space conditioning.
    c. Permanent space enclosure.
    d. Completion of mechanical installation.
    e. Completion of electrical installation.
    f. Substantial Completion.

F. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

G. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

1. See Section 01 29 00 "Payment Procedures" for cost reporting and payment procedures.

H. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and the Contract Time.

I. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Final Completion percentage for each activity.

J. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

K. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.8 STARTUP CONSTRUCTION SCHEDULE

A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within seven days of date established for commencement of the Work, the Notice to Proceed or the Notice of Award as defined in the General Condition for Construction.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.9 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for commencement of the Work, the Notice to Proceed or the Notice of Award as defined in the General Condition for Construction.

1. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.10 CPM SCHEDULE REQUIREMENTS

A. Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 days of date established for commencement of the Work, the Notice to Proceed or the Notice of Award, as defined in the General Condition for Construction. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule, so it can be accepted for use no later than 60 days after date established for commencement of the Work, the Notice to Proceed or the Notice of Award, as defined in the General Condition for Construction.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.
b. Mobilization and demobilization.
c. Purchase of materials.
d. Delivery.
e. Fabrication.
f. Utility interruptions.
g. Installation.
h. Work by Owner that may affect or be affected by Contractor's activities.

i. Testing and inspection.
j. Commissioning.
k. Punch list and Final Completion.
l. Activities occurring following Final Completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.

    a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
    b. Total cost assigned to activities shall equal the total Contract Sum.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.

6. Changes in total float or slack time.
7. Changes in the Contract Time.

H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.

    a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
    b. Submit value summary printouts one week before each regularly scheduled progress meeting.

1.11 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 00

SECTION 01 32 33
PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Concealed Work photographs.
3. Periodic construction photographs.
4. Final Completion construction photographs.
5. Preconstruction video recordings.
6. Periodic construction video recordings.
7. Construction webcam.

1.3 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Indicate elevation of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.

1. Submit photos by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in web-based Project management software site:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect and Construction Manager.
d. Name of Contractor.
e. Date photograph was taken.
f. Description of location, vantage point, and direction.
g. Unique sequential identifier keyed to accompanying key plan.

C. Video Recordings: Submit video recordings within seven days of recording.

1. Submit video recordings by uploading to web-based Project management software site. Include copy of key plan indicating each video's location and direction.
2. Identification: With each submittal, provide the following information on web-based Project management software site:

a. Name of Project.
b. Name and address of photographer.
c. Name of Architect and Construction Manager].
d. Name of Contractor.
e. Date video recording was recorded.
f. Description of vantage point, indicating location, direction (by compass point), and elevation of construction.

3. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in three-ring binders. Provide label on front and spine. Include a cover sheet with label information. Include name of Project and date of video recording on each page.

D. Time-Lapse Video: Submit time-lapse sequence video recordings within seven days of recording.

1. Submit time-lapse sequence video recordings monthly by uploading to web-based Project management software site.
2. Identification: For each recording, provide the following information on web-based Project management software site:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect and Construction Manager.
d. Name of Contractor.
e. Date(s) and time(s) video recording was recorded.
f. Description of vantage point, indicating location, direction (by compass point), and elevation of construction.

1.4 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

B. Construction Webcam Service Provider: A firm specializing in providing photographic equipment, web-based software, and related services for construction projects, with a record of providing satisfactory services similar to those required for Project.

1.5 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full high-definition mode with vibration-reduction technology. Provide supplemental lighting in low light levels or backlit conditions.

C. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

D. Metadata: Record accurate date and timefrom camera.

E. File Names: Name media files with date Project area and sequential numbering suffix.

1.6 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Construction Manager.

1. Flag construction limits before taking construction photographs.
2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:

1. Underground utilities.
2. Underslab services.
3. Piping.
4. Electrical conduit.
5. Waterproofing and weather-resistant barriers.

E. Periodic Construction Photographs: Take 50 photographs weekly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

F. Time-Lapse Sequence Construction Photographs: Take 20 photographs as indicated, to show status of construction and progress since last photographs were taken.

1. Frequency: Take photographs weekly, on the same day each week.
2. Vantage Points: Following suggestions by Construction Manager and Contractor, photographer shall select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time, to create a time-lapse sequence as follows:

a. Commencement of the Work, through completion of subgrade construction.
b. Above-grade structural framing.
c. Exterior building enclosure.
d. Interior Work, through date of Substantial Completion.

G. Final Completion Construction Photographs: Take 100 photographs after date of Substantial Completion for submission as Project Record Documents. Construction Manager will inform photographer of desired vantage points.

H. Additional Photographs: Architect or Construction Manager may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.

1. Three days' notice will be given, where feasible.
2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:

a. Special events planned at Project site.
b. Immediate follow-up when on-site events result in construction damage or losses.
c. Photographs shall be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
d. Substantial Completion of a major phase or component of the Work.
e. Extra record photographs at time of final acceptance.
f. Owner's request for special publicity photographs.

1.7 CONSTRUCTION VIDEO RECORDINGS

A. Video Recording Photographer: Engage a qualified videographer to record construction video recordings.

B. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation of construction.

1. Confirm date and time at beginning and end of recording.
2. Begin each video recording with name of Project, Contractor's name, videographer's name, and Project location.

C. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from video recording opposite the corresponding narration segment.

D. Preconstruction Video Recording: Before starting construction, record video recording of Project site and surrounding properties from different vantage points, as directed by Construction Manager.

1. Flag construction limits before recording construction video recordings.
2. Show existing conditions adjacent to Project site before starting the Work.
3. Show protection efforts by Contractor.

E. Periodic Construction Video Recordings: Record video recording monthly. Select vantage points to show status of construction and progress since last video recordings were recorded. Minimum recording time shall be 30 minutes(s).

F. Time-Lapse Sequence Construction Video Recordings: Record video recording to show status of construction and progress.

1. Frequency: During each of the following construction phases, set up video recorder to automatically record one frame of video recording every five minutes, from same vantage point each time, to create a time-lapse sequence of 30 minutes in length as follows:

    a. Commencement of the Work, through completion of subgrade construction.
    b. Above-grade structural framing.
    c. Exterior building enclosure.

2. Timer: Provide timer to automatically start and stop video recorder, so recording occurs only during construction work hours.
3. Vantage Points: Following suggestions by Construction Manager and Contractor, photographer shall select vantage points.

1.8 CONSTRUCTION WEBCAM

A. Webcam: Provide two fixed-location camera(s) with weatherproof housing, mounted to provide unobstructed view of construction site from location approved by Architect, with the following characteristics:

1. Remotely controllable view with mouse-click user navigation for horizontal pan, vertical tile, and optical zoom of 500 percent minimum.
2. Capable of producing minimum 12 megapixel images.
3. Provide pole mount, power supply, active high-speed data connection to service provider's network, and static public IP address for each camera.

B. Live Streaming Images: Provide web-accessible image of current site image, updated at five - minute intervals during daytime operation.

C. Web-Based Interface: Provide online interface to allow viewing of each high-definition digital still image captured and stored during construction, from the Internet.

1. Access Control: Provide password-protected access for Project team administered by Contractor, providing current image access and archival image access by date and time, with images downloadable to viewer's device.
2. Software: Provide responsive software interface for use on computer, tablet, and mobile screens with accompanying iPhone/iPad app and Android apps.
3. Storage: Maintain images on the website for reference during entire construction period, and for not less than 30 days after Final Completion. Provide sufficient memory on remote server to store all Project images.
4. Online Interface: Provide website interface with Project and client information and logos, calendar-based navigation interface for selecting images, and pan and zoom capability within high-definition images.
5. Forward and Reverse: Provide capability to browse through images, moving forward and backward in time by individual image and by day.
6. Slideshow: Provide capability to automatically display current images from sites when there are three or more cameras used.
7. Time-Lapse: Provide capability for online display of project time-lapse.
8. Dashboard: Provide capability to view thumbnails of all cameras on one screen.
9. Weather: Provide corresponding weather data for each image captured.
10. Provide public viewer open access to most recent Project camera image.

D. Maintain cameras and web-based access in good working order, according to web-based construction photographic documentation service provider's written instructions until Final Completion. Provide for service of cameras and related networking devices and software.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 33

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's and Construction Manager's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled date of fabrication.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Construction Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect and Construction Manager on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.6 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

    a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect and Construction Manager.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's and Construction Manager's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

1.7 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams that show factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. BIM Incorporation: Construction Manager will incorporate Contractor's Shop Drawing files into BIM established for Project.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.

3. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.8 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. BIM Incorporation: Construction Manager will incorporate delegated-design drawing and data files into BIM established for Project.

1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as original Drawings.

1.9 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with indication in web-based Project management software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect and Construction Manager will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S AND CONSTRUCTION MANAGER'S REVIEW

A. Action Submittals: Architect and Construction Manager will review each submittal, indicate corrections or revisions required.

1. Submittals by Web-Based Project Management Software: Architect and Construction Manager will indicate, on Project management software website, the appropriate action.

B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect and Construction Manager.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect and Construction Manager will return without review submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 33 00

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.

1. Mockups are used for one or more of the following:

    a. Verify selections made under Sample submittals.
    b. Demonstrate aesthetic effects.
    c. Demonstrate the qualities of products and workmanship.
    d. Demonstrate successful installation of interfaces between components and systems.
    e. Perform preconstruction testing to determine system performance.

2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect or Construction Manager.

1.4 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.6 ACTION SUBMITTALS

A. Mockup Shop Drawings:

1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.7 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

F. Reports: Prepare and submit certified written reports and documents as specified.

G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award or Notice to Proceed, as defined in the General Condition for Construction, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.

B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.9 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.10 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.

1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following Contractor's responsibilities, including the following:

1. Provide test specimens representative of proposed products and construction.
2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
4. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
5. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
6. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect or Construction Manager.
3. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's and Construction Manager's approval of mockups before starting corresponding Work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

1.11 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.

    a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Architect, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and Construction Manager's and authorities' having jurisdiction reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00
REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Abbreviations and acronyms not included in this list shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.

26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASSP - American Society of Safety Professionals (The); www.assp.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AVIXA - Audiovisual and Integrated Experience Association; (Formerly: Infocomm International); www.soundandcommunications.com.
38. AWEA - American Wind Energy Association; www.awea.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWPA - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
50. CDA - Copper Development Association; www.copper.org.
51. CE - Conformite Europeenne; www.ec.europa.eu/growth/single-market/ce-marking.
52. CEA - Canadian Electricity Association; www.electricity.ca.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.compositepanel.org.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csa-group.org.
65. CSI - Construction Specifications Institute (The); www.csiresources.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTA - Consumer Technology Association; www.cta.tech.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.coolingtechnology.org.
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
71. DHA - Decorative Hardwoods Association; (Formerly: Hardwood Plywood & Veneer Association); www.decorativehardwoods.org.

72. DHI - Door and Hardware Institute; www.dhi.org.
73. ECA - Electronic Components Association; (See ECIA).
74. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
75. ECIA - Electronic Components Industry Association; www.ecianow.org.
76. EIA - Electronic Industries Alliance; (See TIA).
77. EIMA - EIFS Industry Members Association; www.eima.com.
78. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
79. EOS/ESD Association; (Electrostatic Discharge Association); www.esda.org.
80. ESTA - Entertainment Services and Technology Association; (See PLASA).
81. ETL - Intertek (See Intertek); www.intertek.com.
82. EVO - Efficiency Valuation Organization; www.evo-world.org.
83. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
84. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
85. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
86. FM Approvals - FM Approvals LLC; www.fmglobal.com.
87. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
88. FRSA - Florida Roofing, Sheet Metal Contractors Association, Inc.; www.floridaroof.com.
89. FSA - Fluid Sealing Association; www.fluidsealing.com.
90. FSC - Forest Stewardship Council U.S.; www.fscus.org.
91. GA - Gypsum Association; www.gypsum.org.
92. GANA - Glass Association of North America; (See NGA).
93. GS - Green Seal; www.greenseal.org.
94. HI - Hydraulic Institute; www.pumps.org.
95. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
96. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
97. HPVA - Hardwood Plywood & Veneer Association; (See DHA).
98. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
99. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
100. IAS - International Accreditation Service; www.iasonline.org.
101. ICBO - International Conference of Building Officials; (See ICC).
102. ICC - International Code Council; www.iccsafe.org.
103. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
104. ICPA - International Cast Polymer Association; www.theicpa.com.
105. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
106. IEC - International Electrotechnical Commission; www.iec.ch.
107. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
108. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
109. IESNA - Illuminating Engineering Society of North America; (See IES).
110. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
111. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
112. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
113. II - Infocomm International; (See AVIXA).
114. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
115. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
116. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
117. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
118. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
119. ISO - International Organization for Standardization; www.iso.org.
120. ISSFA - International Solid Surface Fabricators Association; (See ISFA).

121. ITU - International Telecommunication Union; www.itu.int.
122. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
123. LMA - Laminating Materials Association; (See CPA).
124. LPI - Lightning Protection Institute; www.lightning.org.
125. MBMA - Metal Building Manufacturers Association; www.mbma.com.
126. MCA - Metal Construction Association; www.metalconstruction.org.
127. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
128. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
129. MHI - Material Handling Industry of America; www.mhia.org.
130. MIA - Marble Institute of America; (See NSI).
131. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
132. MPI - Master Painters Institute; www.paintinfo.com.
133. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
134. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
135. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
136. NADCA - National Air Duct Cleaners Association; www.nadca.com.
137. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
138. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
139. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
140. NBI - New Buildings Institute; www.newbuildings.org.
141. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
142. NCMA - National Concrete Masonry Association; www.ncma.org.
143. NEBB - National Environmental Balancing Bureau; www.nebb.org.
144. NECA - National Electrical Contractors Association; www.necanet.org.
145. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
146. NEMA - National Electrical Manufacturers Association; www.nema.org.
147. NETA - InterNational Electrical Testing Association; www.netaworld.org.
148. NFHS - National Federation of State High School Associations; www.nfhs.org.
149. NFPA - National Fire Protection Association; www.nfpa.org.
150. NFPA - NFPA International; (See NFPA).
151. NFRC - National Fenestration Rating Council; www.nfrc.org.
152. NGA - National Glass Association (The); (Formerly: Glass Association of North America); www.glass.org.
153. NHLA - National Hardwood Lumber Association; www.nhla.com.
154. NLGA - National Lumber Grades Authority; www.nlga.org.
155. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
156. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
157. NRCA - National Roofing Contractors Association; www.nrca.net.
158. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
159. NSF - NSF International; www.nsf.org.
160. NSI - National Stone Institute; (Formerly: Marble Institute of America); www.naturalstoneinstitute.org.
161. NSPE - National Society of Professional Engineers; www.nspe.org.
162. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
163. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
164. NWFA - National Wood Flooring Association; www.nwfa.org.
165. NWRA - National Waste & Recycling Association; www.wasterecycling.org
166. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
167. PDI - Plumbing & Drainage Institute; www.pdionline.org.
168. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
169. RCSC - Research Council on Structural Connections; www.boltcouncil.org.

170. RFCI - Resilient Floor Covering Institute; www.rfci.com.
171. RIS - Redwood Inspection Service; www.redwoodinspection.com.
172. SAE - SAE International; www.sae.org.
173. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
174. SDI - Steel Deck Institute; www.sdi.org.
175. SDI - Steel Door Institute; www.steeldoor.org.
176. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
177. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
178. SIA - Security Industry Association; www.siaonline.org.
179. SJI - Steel Joist Institute; www.steeljoist.org.
180. SMA - Screen Manufacturers Association; www.smainfo.org.
181. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
182. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
183. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
184. SPIB - Southern Pine Inspection Bureau; www.spib.org.
185. SPRI - Single Ply Roofing Industry; www.spri.org.
186. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
187. SSINA - Specialty Steel Industry of North America; www.ssina.com.
188. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
189. STI - Steel Tank Institute; www.steeltank.com.
190. SWI - Steel Window Institute; www.steelwindows.com.
191. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
192. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
193. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
194. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
195. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
196. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
197. TMS - The Masonry Society; www.masonrysociety.org.
198. TPI - Truss Plate Institute; www.tpinst.org.
199. TPI - Turfgrass Producers International; www.turfgrasssod.org.
200. TRI - Tile Roofing Institute; www.tileroofing.org.
201. UL - Underwriters Laboratories Inc.; www.ul.com.
202. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
203. USAV - USA Volleyball; www.usavolleyball.org.
204. USGBC - U.S. Green Building Council; www.usgbc.org.
205. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
206. WA - Wallcoverings Association; www.wallcoverings.org.
207. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
208. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
209. WDMA - Window & Door Manufacturers Association; www.wdma.com.
210. WI - Woodwork Institute; www.wicnet.org.
211. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
212. WWPA - Western Wood Products Association; http://www.wwpa.org. Retain "Code Agencies" Paragraph below if required. The Section Text in MasterSpec Sections is prepared assuming list is retained.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.

6. MILSPEC - Military Specification and Standards; (See DOD).

7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program;www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 USE CHARGES

A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with galvanized barbed-wire top strand.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide concrete galvanized-steel bases for supporting posts.

C. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

2.2 TEMPORARY FACILITIES

A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, Construction Manager, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction.

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service.

1. Arrange with utility company and Owner for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to private system indicated as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of Owner's new toilet facilities is not permitted.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment and one land-based telephone line(s) for each field office.

1. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Construction Manager's home office.
g. Engineers' offices.
h. Owner's office.
i. Principal subcontractors' field and home offices.

I. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas.
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.

4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course.

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Provide temporary offsite parking areas for construction personnel.

F. Storage and Staging: Use designated areas of Project site for storage and staging needs.

G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

H. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touch up signs, so they are legible at all times.

I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."

J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 01 10 00 "Summary."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

G. Site Enclosure Fence: Prior to commencing earthwork, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

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SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 33 00 "Submittal Procedures."

F. Substitution: Refer to Section 01 25 00 "Substitution Procedures" for definition and limitations on substitutions.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Resolution of Compatibility Disputes between Multiple Contractors:

a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

a. Name of product and manufacturer.
b. Model and serial number.
c. Capacity.
d. Speed.
e. Ratings.

1.5 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

a. Submit additional documentation required by Architect through Construction Manager in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."

2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

    a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

4. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

    a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

    a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

    1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 33 00 "Submittal Procedures."

1. Form of Approval of Submittal: As specified in Section 01 33 00 "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00
EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner's portion of the Work.
6. Coordination of Owner-installed products.
7. Progress cleaning.
8. Starting and adjusting.
9. Protection of installed construction.
10. Correction of the Work.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.4 PREINSTALLATION MEETINGS

A. Layout Conference: Conduct conference at Project site.

1. Prior to establishing layout of new perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Architect and Construction Manager of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:

a. Contractor's superintendent.
b. Professional surveyor or Professional engineer Contractor's personnel responsible for performing Project surveying and layout.

c. Professional surveyor or Professional engineer responsible for performing site survey serving as basis for Project design.

2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
3. Review requirements for including layouts on Shop Drawings and other submittals.
4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor or professional engineer.

B. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.

C. Certificates: Submit certificate signed by land surveyor or professional engineer, certifying that location and elevation of improvements comply with requirements.

D. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

E. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.6 CLOSEOUT SUBMITTALS

A. Final Property Survey: Submit 5 copies showing the Work performed and record survey data.

1.7 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Professional Engineer Qualifications: Refer to Section 01 40 00 "Quality Requirements."

C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Plumbing piping systems.
    f. Mechanical systems piping and ducts.
    g. Control systems.
    h. Communication systems.
    i. Fire-detection and -alarm systems.
    j. Electrical wiring systems.
    k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.
    d. Sprayed fire-resistive material.
    e. Equipment supports.
    f. Piping, ductwork, vessels, and equipment.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

B. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect through Construction Manager in accordance with requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect and Construction Manager promptly.

B. Engage a land surveyor or professional engineer experienced in laying out the Work, using the following accepted surveying practices:

1. Establish benchmarks and control points to set lines and levels of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb, and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

E. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

F. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of Work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

E. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

F. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's construction personnel and Owner's separate contractors.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel and Owner's separate contractors.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

2. Preinstallation Conferences: Include Owner's construction personnel and Owner's separate contractors at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 WASTE MANAGEMENT GOALS FOR THE PROJECT

A. This Project shall minimize the creation of construction and demolition waste on the job site. Factors that contribute to waste, such as over packaging, improper storage, ordering error, poor planning, breakage, mishandling, and contamination, shall be minimized. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.

B. Diversion Goals: A minimum 50% of total Project waste shall be diverted from landfill. Records shall be kept to attempt for verification. The following waste categories, at a minimum, shall be diverted from landfill:

1. Land-clearing debris
2. Clean dimensional wood, pallet wood
3. Plywood, OSB, and particleboard
4. Concrete
5. Bricks
6. Concrete Masonry Units (CMU)
7. Asphaltic concrete
8. Electrical wiring
9. Cardboard, paper, packaging
10. Aluminum
11. Steel
12. Gypsum drywall (unpainted)
13. Paint
14. Glass
15. Plastics
16. Carpet and pad
17. Beverage containers

1.3 REFERENCES, RESOURCES

A. WasteSpec, Triangle J Council of Governments, PO Box 12276, Research Triangle Park, NC 27709

B. California Integrated Waste Management Board, 916/255-2296, e-mail: opa@ciwmb.ca.gov

1.4 WASTE MANAGEMENT PLAN

A. Produce and submit a Waste Management Plan. The Plan shall contain the following:

1. Estimate of total Project waste to be generated, name of the landfill(s) where Project waste would normally be disposed of, tipping fees, and estimated cost of disposing of Project waste in landfill(s).

    a. Provide the name of the landfill(s) where trash will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all Project waste in the landfill(s).
    b. Identify licensed haulers and processors of recyclables for categories of materials to be separated.

2. Estimate of total tons of the following waste category to be diverted from landfill:

    a. Concrete
    b. Asphaltic Concrete
    c. Brick
    d. Other

3. Estimate of total cubic yards of the following waste categories to be diverted from landfill:

    a. Clean dimensional wood, pallet wood
    b. Plywood, OSB, and particleboard
    c. Cardboard, paper, packaging
    d. Other

4. Estimate of amounts (weight, feet, square yards, gallons, etc.) of the following waste categories:

    a. Aluminum
    b. Steel
    c. Copper
    d. Carpet
    e. Paint
    f. Other

5. Estimate of net cost savings or additional costs resulting from separating and recycling (versus landfilling) each material. “Net” means that the following have been subtracted from the cost of separating and recycling:

    a. Revenue from the sale of recycled or salvaged materials
    b. Landfill tipping fees saved due to diversion of materials from the landfill

1.5 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used at the appropriate stages of the Project.

B. Conduct Construction Waste Management meetings.

C. Separation Facilities: Designate a specific area or areas to facilitate separation of materials for potential reuse, salvage, recycling, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid commingling of materials. Bins shall be protected during non-working hours from off-site contamination.

1. Separate, store, protect, and handle at the site identified recyclable and salvageable waste products in order to prevent contamination of materials and to maximize recyclability and salvageability of identified materials.

D. Materials Handling Procedures: Materials to be recycled shall be protected from contamination and shall be handled, stored, and transported in a manner that meets the requirements set by the designated facilities for acceptance.

E. Transportation: A description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site) and destination of materials. Provide an estimate of how often bins will need to be emptied.

F. Hazardous Wastes: Hazardous wastes shall be separated, stored, and disposed of according to local regulations.

1. Recycle any thermostats to be discarded to Thermostat Recycling Corporation (703) 841 3249 or www.nema.org/trc

G. Application for Progress Payments: Submit with each Application for Progress Payment a Summary of the Project waste generated. Failure to submit this information may render the Application for Payment incomplete and may delay Progress Payment. The Summary shall contain the following information:

1. The amount (in tons or cubic yards) of material landfilled from the Project, the identity of the landfill, the total amount of tipping fees paid at the landfill, and the total disposal cost. Include manifests, weight tickets, receipt, and invoices.
2. For each material recycled, reused, or salvaged from the Project, include the amount (in tons or cubic yards, pounds, feet, square yards, gallons, etc.), the date removed from the job site, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of salvage or recycling each material. Attach manifests, weight tickets, receipts, and invoices.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 74 19

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SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.

1.3 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.5 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.7 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's and Owner's signature for receipt of submittals.

5. Submit testing, adjusting, and balancing records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and

tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.8 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 01 29 00 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.9 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect and Construction Manager.
    d. Name of Contractor.

e. Page number.

4. Submit list of incomplete items in the following format:

a. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

1.10 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit by uploading to web-based project software site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site of rubbish, waste material, litter, and other foreign substances.

b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
i. Vacuum and mop concrete.
j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
l. Remove labels that are not permanent.
m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

    1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.

q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
r. Clean strainers.
s. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Section 01 73 00 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 77 00

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit by uploading to web-based project software site. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

E. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.

7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

1.11 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 23

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SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record prints.
2) Submit Record Digital Data Files of plots.
3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit PDF electronic files of scanned Record Prints.
2) Print each drawing, whether or not changes and additional information were recorded.

c. Final Submittal:

1) Submit Record Digital Data Files.
2) Plot each drawing file, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Construction Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as for the original Contract Drawings.
2. Format: RVT., Version V2021, Microsoft Windows operating system.
3. Format: Annotated PDF electronic file with comment function enabled.
4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
5. Refer instances of uncertainty to Architect through Construction Manager for resolution.
6. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.

    a. See Section 01 31 00 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
    b. Architect will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Format: Annotated PDF electronic file with comment function enabled.
2. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
3. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect and Construction Manager.
    e. Name of Contractor.

1.5 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file.

1.6 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.7 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.8 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's and Construction Manager's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 39

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For facilitator.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Architect.
d. Name of Construction Manager.

e. Name of Contractor.
f. Date of video recording.

2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 01 78 23 "Operation and Maintenance Data."

1.5 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.7 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.
    j. Operating procedures for system, subsystem, or equipment failure.
    k. Seasonal and weekend operating instructions.

l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.8 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD modewith vibration reduction technology.

1. Submit video recordings by uploading to web-based Project software site.
2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:

    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. Email address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

    a. Produce segments to present a single significant piece of equipment per segment.
    b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration by microphone while dubbing audio narration or off-site after video recording is recorded. Include description of items being viewed.

F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 79 00

SECTION 01 80 15
SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Green Globes, Environmental Assessment of Building Design, is being used on this project as the benchmark for the sustainable design of the building.

B. Green Building Initiative, GBI Proposed American National Standard 01-2008P: Green Building Assessment Protocol for Commercial Buildings provides a method of assessing commercial building projects in relation to commonly valued environmental and efficiency outcomes.

C. The Green Building Initiative™ (GBI) is a not-for-profit organization that in 2005 became accredited as a standards developer by ANSI. GBI owns the U.S. license for Green Globes™—the first web-based and fully interactive green building rating system to encompass both design guidance, education and environmental assessments for commercial buildings. Green Globes™ is a unique green management tool in that it offers flexibility, ease-of-use and affordability, while maintaining its effectiveness as an approach to assess green building design, construction, and delivery processes.

D. Achievement Levels:

Achievement Levels: Levels	Percentage of Applicable Points required out of a 1000 Possible Points	Description
Level 4	85 – 100%	Reserved for select building design and delivery processes that serve as national or world leaders in design and delivery focused on reducing environmental impacts.
Level 3	70 – 84%	Demonstrates leadership in design and delivery of energy and environmentally sensitive buildings and a commitment to continual improvement.
Level 2	55 – 69%	Demonstrates excellent progress in reducing environmental impacts by applying best practices in energy and environmental design and delivery.

Level 1	35 – 54%	Demonstrates movement beyond awareness and a commitment to good energy and environmental design and delivery practices.

D. Assessment of compliance with a specific Level of Achievement can be established through third-party review of appropriate written plans, working drawings, specifications, site plans, energy modeling, life cycle assessment results, commissioning reports, construction documents and/or other data or documents that demonstrate conformance.

E. This project will achieve LEVEL 1.

F. Contractor to forward all current copies of the mechanical sections of the contract documents to the CXA for third party review by the CXA.

PART 2 - GENERAL

PART 3 - EXECUTION

END OF SECTION 01 80 15

Division 02

Existing Conditions

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SECTION 02 82 04
SPORTS FIELD SITE PREPARATION

PART I – GENERAL

1.1 SCOPE OF WORK

A. Provide all labor, materials, equipment and incidentals necessary to treat the existing vegetation with herbicide and perform grading activities.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02 82 08 – Sports Field Sodding

1.3 SUBMITTALS

A. The Contractor shall submit labels for the herbicides to the Owner for review and approval at least two weeks prior to use.

1.4 EXECUTION

A. The Contractor shall install the protective fencing to secure the project site.

B. The Contractor shall spray the herbicide in accordance with the manufacturer's requirements. If required, the Contractor shall re-apply the herbicide ten (10) days after the initial treatment to ensure that all vegetation within the project area is dead.

C. The Contractor shall till the fields to a depth of twelve (12) to eighteen (18) inches, incorporating all dead organic matter. The Contractor shall perform minor shaping of the tilled area to ensure positive drainage off the playing area. Refer to Civil Engineering Plans for percent (%) crown to be maintained on soccer field.

PART 2 – MATERIALS

2.1 HERBICIDE

A. The Contractor shall use a non-selective herbicide such as Roundup by Monsanto, or approved equal. The herbicide shall be EA approved for the use.

B. The Contractor shall provide the owner with an MSDS sheet on the herbicide.

C. The Contractor shall insure that no overspray goes beyond the project limits. If overspray goes beyond these limits, the Contractor shall remove and replace affected plant material. Likewise, if workers or equipment track the material beyond the project site, the Contractor shall repair such damage.

END OF SECTION 02824

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SECTION 02 82 08
SPORTS FIELD SODDING

PART I – GENERAL

1.1 SCOPE OF WORK

A. Provide all labor, materials, equipment and incidentals necessary to install the sports field turf areas in accordance with the drawings and as specified, including soil amendments, fertilizers, fungicides, irrigation, etc. during grow in and maintenance of the field until acceptance by the Owner.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02 82 04 – Sports Field Site Preparation
B. Section 02 75 00 – Irrigation

1.3 BERMUDA GRASS SPORTS FIELD INSTALLER QUALIFICATIONS

A. Contractor specializing in the grading and grassing of the sports fields shall grade and install the Bermuda grass field. The specialty contractor shall submit a list of sports field projects successfully completed during the past three years, including a list of three similar sports field projects for the approval of the Owner. Include information concerning the project owner and references with telephone contact numbers.

1.4 SUBMITTALS

A. The Contractor shall submit labels for fertilizer, amendments, pesticides and herbicides to the Owner for review and approval at least two weeks prior to use.

B. Submit a pesticide safety plan provided by a certified pesticide applicator. The safety plan shall detail storage locations, handling, accident procedure and environmental contamination plan.

C. Contractor shall submit existing and imported soils for physical nutritional analysis by an accredited laboratory (ex. A & L Southern Agricultural Labs in Deerfield Beach) at no cost to the Owner prior to the start of work on the sodding. Nutritional analysis to include phosphorus, potassium, calcium, magnesium, sulfur, boron, copper, iron, manganese, zinc, pH, cation exchange capacity (CEC), organic matter, salts and recommendations to bring soils to proper nutrient and pH levels in accordance with industry standards for modified native sand soil based athletic fields. Physical analysis to include porosity, hydraulic conductivity, (percolation rate / infiltration rate), whether or not sand is calcareous, percent and range of particle sizes for sand, slit, clay organic matter, salts and recommendation to amend soils to industry standards for modified native sand soil based athletic fields. Submit three (3) one-gallon representative sample of all material to be tested. Representative sample should be taken from the top 6 inches of soil from fifteen (15) different locations as evenly spaced as possible throughout the field. Combine all fifteen (15) samples together so as to form a homogenous blend of the fifteen (15)

representative soil samples. From that homogenous blend, fill three (3) one-gallon Zip-lock bags with the mixed soil. Samples are to be place into one-gallon Zip-Lock bags. Place the Zip-lock bag containing the sample into another Zip-Lock bag, top end of the first bag at the bottom end of the second bag. All samples should be labeled and easily identifiable. Samples should be packaged securely in double Zip-Lock plastic bags inside card boxes marked “To Be Planted”. Location of sampled material shall be indicated on a grid pattern submittal per field.

D. Submit planting soil analyses of the existing and imported soils to the Owner for review and approval. The analysis shall show % of organic material in the soil through the loss on Ignition by Volume soil test method, indicate the soil pH and with recommendations from the testing laboratory for additional topsoil, fertilizer type and application rate, and other soil amendments necessary to bring the top 6" of soils in the sports field areas to the following specified levels:

1. Percolation rate: minimum 6" per hour in the top six inches of soil.
2. PH level: 6.0 - 7.0.
3. Soil Organic Content 5% minimum /20% maximum.
4. Major and Minor nutrients as recommended by the laboratory.
5. An accredited South Florida agricultural testing laboratory acceptable to the Owner shall perform all testing and recommendations.
6. Fire ant certification from the sod supplier.
7. Specialty grading and grassing contractor information as noted in Section 1.03 above.
8. Contract Closeout: Procedures for submittals.
9. Operation Data: Submit for continuing Owner maintenance.
10. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height, types, application frequency, and recommended coverage of fertilizer.

1.5 GENERAL REQUIREMENTS:

A. All athletic field areas shall be laser graded prior to sodding to achieve positive drainage. Refer to Civil Engineering plans for grades and slopes.

B. Upon instance where positive drainage cannot be obtained through grade alone the Contractor shall notify the Owner and the need for corrective measures will be considered on a case by case basis and negotiated based on time and materials.

C. Prior to sodding an irrigation walk thru shall be conducted by Contractor in conjunction with Owner to agree upon current irrigation system status.

D. Recheck and verify automatic operation of the irrigation system. Review with Owner irrigation area coverage and uniformity prior to sodding to ensure that 100% irrigation coverage is achieved in all newly sodded sports field areas.

PART 2 – MATERIALS

2.1 ROLL SOD

A. Sod shall be vendor certified as TifSport® Bermuda Grass or Owner approved alternate. The sod shall be mechanically cut in rolls measuring 42" wide x 75' long. The sod shall be cut with 1 1/2" root zone. The Contractor shall provide the Owner with copies of the delivery invoice slips. Roll sod shall be vendor certified Tifsport Bermuda Grass or Owner approved alternate. All sod must be delivered within 24 hours of cutting and in healthy condition. The Owner shall reject any sod which is found to be excessively dry, chlorotic, or contains pest or is of inferior quality.

2.2 FERTILIZER

A. Fertilizer shall be balanced commercial grade fertilizer or as required by the soils test. It shall be delivered to the site in the original unopened containers each showing the manufacturer's guarantee analysis. Store fertilizer so that when used it shall be dry and free flowing.

B. "Sul-Po-Mag" (Potassium-Magnesium-Sulfate supplement) at 2000 lb./acre.

2.3 SOIL AMENDMENTS

A. The soil shall be amended so that it meets industry standards for modified native sand soil based athletic fields as recommended by accredited laboratory conducting soil analysis.

2.4 FUMIGANT

A. The Contractor shall apply Basmid - Granular soil fumigant by BASF as per manufacturers recommended application rate and procedure. The Contractor shall furnish the Owner with an MSDS sheet on the material.

PART 3 – EXECUTION

3.1 SOIL ANALYSIS

A. Prior to sodding, the sports field areas will be tested in accordance with USDA standards. The Contractor shall conduct for soil pH, nutrient level, permeability and other factors as stated in section 1.04 above. The test results will be used to develop the

recommendation for amending the soils. The Contractor will bring the soils to the recommended mixture, as part of the work of preparing the sod bed.

3.2 SOIL FUMIGATION:

B. The Contractor shall fumigate all sports field areas at the rate specified by manufacturer, observe all manufacturer requirement for application of the material, in accordance with all local codes and ordinances by a certified applicator. Submit plan to Owner for approval. Dazomet (Basamid Granular Soil Fumigant) is the product to be used.

3.3 FINE GRADING

A. After removal of debris, perform fine grading as required to bring all areas to receive grass to a smooth, even, and finished grade. Use a laser grader to fine grade areas receiving Bermuda grass. Fine grade other areas receiving grass by raking to eliminate wind rows, ridges, depressions and other irregularities. The Contractor shall fine grade areas to be sodded as necessary to achieve a finished grade (top of the sod) as specified in this section.

B. All sodded areas bordered by sidewalks, asphalt pavement, or curbs shall have a finished grade (top of the sod's soil) that is flush (or less than ½" below) with the grade of the adjacent sidewalk, asphalt pavement, or curb.

C. All sodded areas bordered by planting areas shall have a finished grade (top of the sod's soil) that is 1½" above the soil level in the adjacent planting bed.

3.4 SOD BED/SOIL PREPARATION:

A. The Contractor shall rototill all fields to a depth of twelve (12) to eighteen (18) inches and incorporate the following soil amendments:

1. "Sul-Po-Mag" (Potassium-Magnesium-Sulfate supplement) at 2000 lb./acre.

2. All other amendments recommended by accredited laboratory based on soil analysis and industry standards and as approved by Owner for modified native sand based athletic fields.

3. Surface layer application of 10-10-10 “Start-Up” fertilizer at 1000 lb./acre.

B. Fertilizing operations shall not be performed when the wind velocity exceeds 15 miles per hour.

3.5 SODDING:

A. The work consists of sod bed preparation, soil preparation and sodding in strict accordance with the specifications and the applicable drawings to produce a sports field acceptable to the Owner.

B. Sod Bed Preparation: All areas that are to be sodded shall be lazer graded and free of pests and debris that would cause abnormal growth and/or inhibit growth. The whole

surface shall be rolled with a roller weighing not more than one-hundred (100) pounds per foot of width. During the rolling, all depressions caused by settlement of rolling shall be filled with additional soil, and the surface shall be regraded and rolled until presenting a smooth and even finish that is up to the required grade.

C. Soil Preparation: Apply “Sul-Po-Mag” (Potassium-Magnesium-Sulfate supplement) at 2000 lb./acre. Application shall be uniform utilizing approved mechanical spreaders. Mix fertilizer thoroughly within the soil to a depth of four (4) inches. Hand rake until all bumps and depressions are removed. Wet prepared area thoroughly.

D. Sodding

1. The Contractor shall sod all areas that are designated on the drawings within the contract limits, unless specifically noted otherwise.

2. The sod shall be certified to meet Florida State Plant Board Specifications, absolutely true to species specified herein, and free pests of any kind. Further, sod shall be certified to be free of tropical soda apple seeds and weeds. Contractor shall provide certification of sod source.

3. Remove plastic webbing on sod rolls prior to installation. Sod rolls shall be laid in straight runs, tightly together so as to make a solid sodded turf area. Immediately following sod laying, the turf areas shall be rolled with a turf roller, customarily used for such purpose and then thoroughly irrigated. If, in the opinion of the Owner, top-dressing is necessary after rolling to fill the voids between the sod rolls/runs and to even out inconsistencies in the sod, clean, washed sand (Play Sand) as approved by the Owner shall be uniformly spread over the entire surface of the sod and thoroughly watered in.

4. Lay sod within 36 hours of being lifted.

E. During delivery, prior to and during the planting of the sports field areas, the sod rolls shall at all times be protected from excessive drying and unnecessary exposure of the roots to the sun. All sod shall be stored so as not be damaged by sweating or excessive heat and moisture.

3.6 IRRIGATION:

A. Water sod immediately after planting. Keep planted areas continuously moist by watering as often as required during the first three weeks following planting (or until rooting occurs). Once rooting occurs, decrease watering frequency to once daily at a rate of 1/4" of water per application.

3.7 CLEAN UP

A. Upon completion of the work, all debris, fertilizer bags, pallets etc. shall be removed from the site. Any paved areas including curbs and sidewalks shall be thoroughly swept or pressure washed if deemed necessary by the Owner.

PART 4 – WARRANTY/GROW IN PERIOD

4.1 LENGTH

A. The grow in period is to extend 30 days from date of sodding. The warranty period for the sodding is one year from installation or until such time as a 1-year post occupancy evaluation has been conducted and the evaluation has been transmitted to Owner by the Landscape Architect and Owner has accepted the works performed, which ever occurs later.

4.2 MAINTENANCE RESPONSIBILITIES

A. The Contractor is responsible for all maintenance for a period of no less than one (1) year or until such time a 1-year a post occupancy evaluation has taken place and evaluation letter has been issued to Owner by Landscape Architect and Owner has accepted the works performed, which ever occurs later. Maintenance shall include but is not limited to the following:

1. Mowing all sports field areas every week or more or less as required, and visible amounts of grass clippings shall be removed from the sports filed areas. Do not cut the sports field areas in more than 1/4" increments. Sports filed areas shall be maintained at approximately 3/4" height.

2. Eradication of all harmful insects (including ants).

3. Control of all turf and soil diseases.

4. Watering and fertilizing as required to maintain sports field areas in an excellent condition for plant growth and sports field use. Grass is required to be in a healthy and green condition at the time of final acceptance.

5. Eradication of all weeds in the sports field areas as necessary for the grass to conform to the specification in paragraph 2.01.

6. All other work as necessary for the specialty Contractor to ensure a high quality sports field turf.

B. The Contractor is responsible for watering/irrigation of sod. Contractor is responsible for irrigation operation until owner acceptance.

C. The Contractor is responsible for contacting Owner for periodic inspections of turf during grow in period at no more than 7-day intervals.

4.3 POST INSTALLATION FERTILIZATION:

The Contractor shall implement the following fertilization schedule for the playing fields during the 30-day grow in period

A. One week after planting and rooting has occurred, fertilize with ammonium sulfate at the rate of 125 pounds per acre. Water in immediately following application of fertilizer.

B. Weeks two and three, fertilize with 10-10-10 (50% slow release N) at 250 pounds per acre.

C. Week four fertilize with Milorganite or Owner approved equivalent at 1000 lbs/acre.

D. Apply fertilizer during late afternoon to early evening hours only. Watering shall immediately follow fertilization.

E. Fertilizing operations shall not be performed when the wind velocity exceeds 15 miles per hour.

4.2 MOWING:

A. When grass has rooted and reaches a height of approximately 1.5 to 2.0 inches, mow with a sharpened reel mower. Mow at least once per week, or more frequently if necessary so that no more than 1/3 or ¼" (one-quarter of an inch) of the leaf blade is removed at any one time and the sports field areas are maintained at a height of approximately ¾" (three-quarters of one inch).

4.3 PEST MANAGEMENT

A. Mechanically remove weeds when necessary. Spot treatment of herbicide only upon approval of Owner. Owner must approve all boom pesticide applications. The Contractor shall deliver the sports field to the Owner at time of Owner acceptance in a pest free state. Contractor is to notify Owner 24 hours prior to all applications. In case of curative applications of insecticide and /or fungicide Owner is to be notified one hour prior to application.

4.4 COVERAGE

A. At the end of the grow in period, the area which has been sodded shall be covered with fully rooted viable grass of the variety as specified herein. The grass shall be able to withstand the foot-traffic associated with the purpose for which it is intended. There shall be no areas which are not covered with viable, fully rooted grass. Overall there shall be a total coverage of viable, fully rooted grass.

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Division 03

Concrete

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SECTION 03 11 00
CONCRETE FORMING

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of formwork is indicated by the cast-in-place concrete structures shown on the Drawings.

B. The Work includes providing formwork and shoring for cast-in-place concrete and installation into formwork of items furnished by others, such as anchor bolts, setting plates, bearing plates, anchorages, inserts, frames, nosings, and other items to be embedded in concrete (but not including reinforcing steel).

1.2 SUBMITTALS

A. Product Data: Manufacturer's data and installation instructions for proprietary materials including form coatings, manufactured form systems, ties, accessories, and other items specified.

B. Concrete Shoring Formwork: Provide shop drawings and calculations signed and sealed by a Professional engineer registered in the State of Florida.

1.3 QUALITY ASSURANCE

A. Examine the substrate and the conditions under which concrete formwork is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Codes and Standards: Unless otherwise shown or specified, design, construct, erect, maintain, and remove forms and related structures for cast-in-place concrete work in compliance with the American Concrete Institute Standard ACI 347, "Recommended Practice for Concrete Formwork."

C. Allowable Tolerances

1. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347 and as follows:

   a. Variation from plumb in lines and surfaces of columns, piers, walls, and arrises; 1/4 inch per 10 feet, but not more than one inch. For exposed corner columns, control joint grooves, and other conspicuous lines, 1/4 inch in a bay or 20 feet maximum; 1/2" maximum in 40 ft. or more.
   b. Variation in sizes and locations of sleeves, floor openings, and wall openings, 1/4 inch.
   c. Variations in footings plan dimensions, minus 1/2 inch and plus 2 inches; misplacement or eccentricity, 2 percent of the footing width in direction of misplacement but not more than 2 inches; thickness reduction, minus 5 percent.

2. Before concrete placement, check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and locations of concrete members and stability of forming systems.

3. During concrete placement, check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete

1. Unless otherwise shown or specified, construct formwork for exposed concrete surfaces metal, metal-framed plywood-faced, to provide continuous, straight, smooth as-cast surfaces. Furnish in largest practicable sizes to minimize number of joints to conform to joint system shown on Drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

a. Plywood: APA grade-trademarked "B-B Plyform Exterior," mill oiled.

B. Forms for Unexposed Finish Concrete: Form with plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least 2 edges and one side for tight fit.

C. Cylindrical Forms

1. Form round-section members of heavy glass-fiber reinforced plastic or galvanized steel sheets. Butt sections together with bolted or keyed joints. Finish interior joints of forms smooth so there is no visible seam on finished concrete surfaces.
2. Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type adhesive with wax impregnated exterior for weather and moisture protection.

a. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.
b. Provide manufacturer's standard plastic-lined-interior units.

D. Form Units

1. Provide factory-fabricated, adjustable-length, removable, or snap-off metal form ties; design to prevent form deflection and to prevent spalling concrete surfaces upon removal.
2. Unless otherwise shown, provide ties so that portion remaining within concrete after removal of exterior parts is at least one inch from outer concrete surface. Unless otherwise indicated, provide form ties which will leave a hole not larger than one inch diameter in concrete surfaces.
3. Form ties fabricated on the project site and wire ties are not acceptable.

E. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

F. Inserts

1. Provide metal inserts for anchorage of materials or equipment to concrete construction not supplied by other trades and as required for the Work.

2. Provide Fry original reglet as manufactured by Fry Reglet Corporation, Alhambra, California. Reglet shall be made of .050 polyvinylchloride, meeting ASTM Spec. D-1874. Provide steel spacer channel for positive alignment and barrier to grout.
3. Vinyl Chamfer Strips: Shall be Vinylex CSN-1/2 as manufactured by Vinylex Corporation, Knoxville, Tennessee.

2.2 DESIGN OF FORMWORK

A. Design, erect, support, brace, and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork and construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view.
2. Provide Class C tolerances for other concrete surfaces.

B. Design forms and falsework to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.

C. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses and the like for easy removal.

D. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joint and provide backup material at joints as required to prevent leakage and fins.

E. Side forms of footings may be omitted and concrete placed directly against excavation only when requested by Contractor and accepted by Architect. When omission of forms is accepted, provide additional concrete beyond the minimum design profiles and dimensions of the footings as detailed.

F. Side forms are not required at the sides of trench footings or other footings where specifically indicated.

G. Provide temporary openings for cleanouts and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exposed corners and edges indicated using chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Re-tighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper

alignment.

J. Provisions for other Trades: Coordinate openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

PART 3 - EXECUTION

3.1 FORM CONSTRUCTION

A. Construct forms to sizes, shapes, and lines, and dimensions shown to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

B. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.

C. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms in as inconspicuous location as possible, consistent with project requirements.

1. Form intersecting planes to provide true, clean-cut corners, with edge grain of plywood not exposed as form for concrete.

D. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

E. Falsework

1. Erect falsework and support, brace and maintain it to safely support vertical, lateral, and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct falsework so that adjustments can be made for take-up and settlement.
2. Provide wedges, jacks, or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce work or required dimensions.
3. Support form facing materials by members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances.
4. Provide camber in formwork as required for anticipated deflections due to weight and pressures of fresh concrete and construction loads for long span members without intermediate supports.
5. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce work of required dimension.

F. Forms for Exposed Concrete

1. Provide form coatings on forms for all exposed finished concrete. Plywood grain indentations or patterns left in the concrete as a result of the forms are not acceptable.
2. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.
3. Do not use metal cover plates for patching holes or defects in forms.
4. Provide sharp, clean corners at intersecting planes without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
5. Use extra studs, whalers, and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material which will produce bow.
6. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
7. Form molding shapes, recesses, and projections with smooth-finish materials and install in forms with sealed joints to prevent displacement.

G. Corner Treatment

1. Form chamfers with 3/4-inch x 3/4-inch strips, unless otherwise shown. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
2. Unexposed corners may be formed either square or chamfered.

H. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades including those under separate prime contracts. Size and location of openings, recesses, and chases are the responsibility of the trade requiring such items. Accurately place and securely support items to be built into form.

I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

J. Construction Joints: Where footings and walls are divided by construction joints, joints shall have keyways formed. Keyways shall be 1/3 of the dimension of the element in both directions and shall be at least 2 inches thick.

3.2 FORM COATINGS

A. Coat form contact surfaces with form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come in contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.

B. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Set and build into the Work anchorage devices and other embedded items required for other Work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs: Set edge form or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

1. Forms for concrete curbs and bases shall be rigidly held straight and tight so that finished concrete will be level and even.

3.4 REMOVAL OF FORMS

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the Work, may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.5 REUSE OF FORMS

A. Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to the Architect.

END OF SECTION 03 11 00

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of concrete reinforcement is shown on the Drawings and in schedules.

B. The Work includes fabrication and placement of reinforcement for cast-in-place concrete including bars, welded wire fabric, ties, and supports.

1.2 SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for proprietary materials and reinforcement accessories.

B. Shop Drawings: fabrication, bending, and placement of concrete reinforcement. Comply with the ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures." Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements, and assemblies as required for the fabrication and placement of concrete reinforcement. Show building plans with bar sizes, spacing, and quantities for all bent and straight reinforcing bars.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with requirements of the latest edition of the following codes and standards, except as herein modified:

1. American Welding Society, AWS D 1.4 - "Structural Welding Code - Reinforcing Steel."
2. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."
3. American Concrete Institute, ACI 318 "Building Code Requirements for Structural Concrete."

1.4 DELIVERY, HANDLING, AND STORAGE

A. Deliver reinforcement to the project site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

B. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or excessive rust.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Reinforcing Bars (ReBar): ASTM A615, and as follows.

1. Provide Grade 60 for all bars unless noted otherwise in Structural Drawings.
2. Provide Grade 75 for bars if specified in Structural Drawings.

B. Steel Wire: ASTM A1064

C. Welded Wire Fabric (WWF): ASTM A1064, sheets only, no rolled fabric

D. Fibrous Reinforcement: Furnish either nylon or fibrillated polypropylene fibers for plaza wear layer only.

1. Nylon Fibers: 100 percent pure nylon filamentized with a minimum diameter of 23 microns, a length of 3/4 inch, a minimum specific gravity of 1.14 and a minimum tensile strength of 130 ksi. Nylon fibers shall be added to the concrete mix at a rate of one pound per cubic yard.

a. Subject to compliance with requirements, provide one of the following:

1) "Nylon": Nycon Inc., Indianapolis, Indiana
2) "Superiormesh 66": Superior Fiber Products, Mentor, Ohio
3) "Forta Nylon": Forta Corporation, Grove City, Pennsylvania

2. Polypropylene Fibers: 100 percent collated fibrillated polypropylene fibers with a length of 3/4 inch, a minimum specific gravity of 0.09 and a minimum tensile strength of 80 ksi. Polypropylene fibers shall be added to the concrete mix at a rate of one and one-half pounds per cubic yard.

a. Subject to compliance with requirements, provide on of the following:

1) "Fibermix Monofilament M.D.," Fibermesh Company, Chattanooga, Tennessee.
2) "Forta Econo-Net": Forta Corporation, Grove City, Pennsylvania.

E. Supports for Reinforcement (including welded wire fabric): Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place.

1. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.
2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
3. Over waterproof membranes, use precast concrete chairs to prevent penetration of the membrane
4. For footings, trench footings, and grade beams use precast concrete bricks (f'c = 3000 psi min. at 28 days). (Concrete masonry bricks not acceptable).
5. For concrete masonry bond beams use #2 bar laterally, tied to each longitudinal reinforcing bar below to hold bars apart and up from bottom. Space #2 bars at 48 inches o.c.

F. Rebar Ties: Nylon or annealed tie wire as recommended by the ACI.

2.2 FABRICATION

A. Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI "Manual of Standard Practice." In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.

B. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the work.

6. Bar lengths, depths, and bends exceeding specified fabrication tolerances.
7. Bends of kinks not indicated on Drawings or final shop drawings.
8. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the conditions under which concrete reinforcement is to be placed. Do not proceed with the Work until unsatisfactory conditions have been corrected.

B. Notify Architect when steel placement for a concrete pour is nearing a completion so that the Work may be observed.

3.2 INSTALLATION

A. Comply with the specified codes and standards and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement to remove loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.

C. Position, support, and secure reinforcement against displacement by formwork construction, or concrete placement operations. Locate and support reinforcing by precast concrete brick, metal chairs, runners, bolsters, spacers, and hangers as required.

D. Place reinforcement to obtain the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16-gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.

E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with 16-gauge wire. Do not make end laps midway between supporting beams or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps.

F. Provide sufficient numbers of supports and of strengths to carry reinforcement. Do not place reinforcing bars more than 2 inches beyond the last leg of continuous bar support. Do not use supports as bases for runaways for concrete conveying equipment and similar construction loads.

G. Provide standard reinforcing splices by lapping ends, placing bars in contact, and tightly tying wire. Comply with requirements of ACI 318 for minimum lap of spliced bars.

H. Reinforcing steel installed in continuous footings shall run continuous. This shall include specially shaped components with proper lap where corner reinforcing and step footings occur.

I. Provide additional reinforcing around required openings in footings, and slabs having at least a one-foot dimension.

J. Install and mix fiber reinforcement into concrete mix in strict accordance with the manufacturers written installation instructions and in strict accordance with the Structural Engineer's requirements.

END OF SECTION 03 20 00

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes interior and exterior cast-in-place concrete, mix design, placement procedures, and finishes. Work includes, but is not necessarily limited to:

1. Exterior Concrete:

a. Walks, curbs, ramps, steps, and stoops
b. Tactile warning texture equipment pads and bases

2. Interior Concrete:
a. Floor slabs: on grade and elevated
b. Bases, curbs, risers, and steps
c. Footings, pads, piers, columns, beams
d. Recesses for floor finishes requiring same

3. Other Materials

a. Concrete admixtures
b. Waterstops
c. Expansion joint fillers
d. Curing materials
e. Self-leveling underlayment
f. Bonding agent

B. Provide other cast-in-place concrete and related work as shown on the Drawings and specified herein for complete and finished work, except concrete work specifically designated to be provided under the Work of other Sections of these Specifications.

C. The following is by other Sections, meeting the requirements of this Section (unless indicated otherwise).

1. Posts for chain link fencing
2. Bases for exterior equipment
3. Encasement of underground utilities or connections
4. Specifically excluded items
5. Flagpole base

1.2 SUBMITTALS

A. Product Data: Proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, dry-shake finish materials, and other specified items.

1. Include concrete curing materials product data and specification sheets

B. Samples: Include names, sources, and descriptions, as follows:

1. Normal weight aggregates
3. Fiber reinforcement
4. Reglets
5. Waterstops

C. Laboratory test reports for concrete materials and mix design tests.

D. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

E. Minutes of pre-installation conference.

F. Proposed mix designs.

G. Statement from ready-mixed plant verifying conformance to specifications and proposed mix designs.

H. Written approval/certification of concrete curing materials as specified herein.

I. ISO 9001/9002 Registration Certificate for companies that are ISO registered.

1.3 QUALITY ASSURANCE

A. Refer to Division 1 for additional requirements.

B. Standards: Comply with the provisions of the following in accordance with the Florida Building Code 7th Edition (2020), except as otherwise shown or specified.

1. ACI 117 "Standard Tolerances for Concrete Construction and Materials"
2. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete"
3. ACI 301 "Specifications for Structural Concrete for Buildings"
4. ACI 302.1R "Guide for Concrete Floor and Slab Construction"
5. ACI 304R "Guide for Measuring, Mixing, Transporting, and Placing Concrete"
6. ACI 311.4R "Guide for Concrete Inspection"
7. ACI 318-02 "Building Code Requirements for Reinforced Concrete and Commentary"
8. Concrete Reinforcing Steel Institute, "Manual of Standard Practice"
9. Comply with building code requirements which are more stringent than the above.
10. ACI 305 - “Hot Weather Concreting”
11. ACI 306 - “Cold Weather Concreting”

C. Materials may require testing and re-testing, as directed by the Architect, at any time during the

progress of the Work. Allow free access to material stockpiles and facilities. Tests shall be done at the Contractor's expense.

D. Concrete curing materials shall be approved by the manufacturer of the product for the final finish material on the concrete slabs. Submit written approval/certification if requested by the Architect.

E. Material manufacturers shall be ISO 9001/9002 registered or provide proof of documented quality assurance system. Quality system must be registered by an independent registrar who is accredited by the American National Standards Institute (ANSI-RAB) or by another internationally recognized body. ISO 9001/9002 certification or proof of documented quality assurance system shall be included with the material submittals.

1.4 PROJECT CONDITIONS

A. Coordinate installation of inserts and sleeves for other trades. Time delivery so as note to cause delay in the progress of this Work.

B. Installation requirements within this Section are not intended to be restrictive and the Contractor is allowed, when reviewed with the Architect's field representative, to adjust the means and methods used to meet required tolerances. Compliance with required tolerances is the responsibility of the Contractor and adjustment required to meet these shall not be unduly restricted by the Architect or his representative.

1.5 FIELD QUALITY CONTROL

A. Floor Tolerance Measurements: Floor flatness and levelness tests on floor slabs shall be conducted in accordance with the provisions set forth in ASTM E 1155-96 (Reapproved 2001), with the exception of Subparagraphs 7.2.3 and 7.3.2 which may be waived at the Owner's option, also Zi calculation to be used shall be N min. = A/10. Floor tolerance measurements shall be made by the independent testing laboratory within 24 hours after completion of the final troweling operation, and before forms and shores have been removed, measurement shall be taken using a Dipstick Auto-Read Floor Profiler as manufactured by The Edward W. Face Company, Inc. of Norfolk, VA. Results of floor tolerance tests, including a formal notice of acceptance or rejection of the work, shall be provided to the Contractor within 24 hours after data collection.

B. Remedy for Out-of-Tolerance Work: Slab sections measuring at or above both of the specified minimum local F-numbers shall be accepted for tolerance compliance as constructed. Floor slab sections measuring below either (or both) of the specified minimum local F-numbers shall be removed and replaced (in the case of slabs-on-grade), or ground or re-topped (in the case of elevated slabs). No remedies for sub-minimum local F-number sections other than replacement of slabs-on-grade, and grinding or re-topping of elevated slabs will be permitted. For the purposes of this paragraph, a floor section shall be a rectangular area bound by column or half-column lines (i.e. minimum sections area - approximately 100 sq. ft.).

C. Special Conditions (Exceptions): Where room sizes (areas receiving concrete flooring) are restricted to smaller areas due to bearing walls or existing construction making finishing difficult, the Architect's Field Representative will determine acceptable deviations/exceptions in testing requirements.

1. Architect's Field Representative may at his discretion:

    a. Waive entirely testing of small rooms, storage areas, and similar spaces.
    b. Reduce the number and select the location of tests.
    c. Waive penalties between specified and minimum locals.
    d. Require that tolerances exceed minimum locals only.
    e. Waive the requirement for removal of concrete not meeting minimum locals if, in his opinion, repairs can bring floors into acceptable/serviceable tolerances.

1.6 CONCRETE TESTING

A. Cooperate and coordinate with the testing laboratory to perform field quality control testing during concrete work under Division 3 in accordance with the current FBC. Refer to the general notes on the structural drawings.

B. Quality Control Testing During Construction: Perform sampling and testing for field quality control during the placement of concrete, as follows:

1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
2. Slump: ASTM C143, one test for each concrete load at point of discharge, and one for each set of compressive strength test specimens.
3. Concrete Temperature: Test hourly when air temperature is 40 degrees F. and below and when 80 degrees F. and above, and each time a set of compressive test specimens is made.
4. Compression Test Specimens: ASTM C31
5. Compressive Strength Tests: ASTM C39, make 5 (4x8 cylinders) laboratory-cured specimens. One specimen shall be broken at 7 days and three specimens shall be broken at 28 days, and one retained in reserve for later testing if required.

    a. One set for each 100 cubic yards or fraction thereof, of each mix design placed in a day or for each 5,000 sq. ft. of surface area for slab on grade.
    b. One set for each 50 cubic yards or fraction thereof, of each mix design placed in a day or for each 2500 sq. ft. of surface area for elevated slabs (formed or on metal deck) or walls.

C. Report test results in writing to the Architect, Contractor, and ready-mix supplier on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of Contractor, name of concrete supplier and truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure (specific locations are required), design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength and type and amount of fibrous reinforcement, compressive breaking strength, and type of break for both 7 day tests and 28 day tests.

D. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate the specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Architect. The testing service shall conduct tests to determine the strength and other characteristics of the in-place concrete by compression tests on cored cylinders complying with ASTM C42 or by load testing specified in ACI 318 or other acceptable nondestructive testing methods, as directed. The Contractor shall pay for such tests conducted

and other additional testing as may be required, when unacceptable concrete is verified.

E. Evaluation of Quality Control Tests: Do not use concrete delivered to the final point of placement which has slump or total air content outside the specified values.

1. Compressive strength tests for laboratory-cured cylinders will be considered satisfactory if the averages of all sets of 3 consecutive compressive strength tests results equal or exceed the 28 day design compressive strength of the type or class of concrete; and no individual strength test (average of two cylinders) falls below the required compressive strength by more than 500 psi when f'c is 5000 psi or less; or by more than 0.10f'c when f'c is more than 5000 psi.
2. Strength tests of specimens cured under field conditions may be required by the Architect to check the adequacy of curing and protecting of the concrete placed. Specimens shall be molded by the field quality control laboratory at the same time and from the same samples as the laboratory cured specimens.

    a. Provide improved means and procedures for protecting concrete when the 28-day compressive strength of field cured cylinders is less than 85 percent of companion laboratory cured cylinders.
    b. When laboratory cured cylinder strengths are appreciably higher than the minimum required compressive strength, field cured cylinder strengths need not exceed the minimum required compressive strength by more than 500 psi even though the 85 percent criterion is not met.
    c. If individual tests of laboratory cured specimen produce strengths more than 500 psi below the required minimum compressive strength or if tests of field cured cylinders indicate deficiencies in protection and curing, provide additional measures to assure that the load-bearing capacity of the structure is not jeopardized. If the likelihood of low-strength concrete is confirmed and computations indicate the load-bearing capacity may have been significantly reduced, tests of cores drilled from the area in question may be required.

3. If the compressive strength tests fail to meet the minimum requirements specified, the concrete represented by such tests will be considered deficient in strength.

F. Deficient concrete shall be removed as directed by the Architect and replaced by the Contractor without additional cost to the Owner.

1.7 CONCRETE MATERIALS AND MIX DESIGN

A. Concrete Materials and Mix Design:

1. Ready-mixed concrete shall be mixed and delivered in accordance with ASTM C94.
2. Product Data: Submit 2 copies of manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures, bonding agents, waterstops, joint systems, chemical floor hardeners, and dry shake finish materials.
3. Laboratory Test Reports: Submit 2 copies of laboratory test reports for concrete materials and mix design tests. The Architect's review will be for general information only. Production of concrete to comply with specified requirements is the Contractor's responsibility.

B. Tests for Concrete Materials

1. Normal Weight Concrete: Test aggregates by the methods of sampling and testing of ASTM C33.
2. Portland Cement: Sample cement and determine the properties by the methods of test ASTM C33.
3. Submit written reports for each material sampled and tested, prior to the start of Work. Provide the project identification name and number, date of report, name of Contractor, name of concrete testing service, source of concrete aggregates material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

C. Submit signed statement form ready-mix plant that concrete furnished for the Project will exactly conform to the approved design mixes.

D. For slabs that are to receive moisture sensitive flooring:

1. Contractor shall work with the ready mix supplier to provide a mix design that will be at or below 75% relative humidity at the time the flooring is scheduled to be installed.
2. Do not use lightweight aggregates.
3. Provide a mix with good self-desiccating properties. Consider adding 2%-4% Silica Fume.
4. Do not hard trowel the surface but instead provide a lightly troweled surface.

1.8 PREINSTALLATION CONFERENCE

A. At least 35 days prior to the start of the concrete construction schedule, conduct a preinstallation conference at the project site to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete construction.

B. Require representatives of every party who is concerned with the concrete work to attend the conference, including, but not limited to, the following:

1. Contractor’s superintendent.
2. Testing laboratory.
3. Concrete subcontractor.
4. Ready-mix concrete producer.
5. Admixture manufacturer(s).
6. Owner.
7. Architect.
8. Structural Engineer.

C. Meeting Minutes: Record, type and distribute within three (3) days of the meeting.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150

1. Use one brand of cement throughout project.

B. Fly Ash: ASTM C 618, Type F, may be substituted for up to 25 percent of the portland cement in all concrete mixes unless noted otherwise.

C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.
3. Fine Aggregate: Clean, sharp, natural sand free from loam, clay lumps, or other deleterious substances.
4. Coarse Aggregate: Clean, un-coated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:

    a. Crushed stone, processed from natural rock or stone.
    b. Washed gravel, either natural or crushed. Use of pit or bankrun gravels not permitted.
    c. Maximum Aggregate Size: Not larger than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourths of minimum clear spacing between individual reinforcing bars or bundles of bars.

5. Aggregate Supply: Provide aggregates from one source of supply to ensure uniformity in color, size, and shape.

D. Water: Potable.

2.2 CONCRETE ADMIXTURES

A. Provide admixtures produced by established reputable manufacturers and use in compliance with manufacturer's printed directions. Do not use admixtures which have not been incorporated and tested in accepted mixes, unless otherwise authorized specifically in writing by Architect.

6. Air-Entraining Admixture: ANSI/ASTM C260
7. Water-Reducing Admixture: ANSI/ASTM C494, Type A.
8. Set-Control Admixture: ANSI/ASTM C494
9. Super Plasticizer: ANSI/ASTM C494, Type F.

B. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

1. Subject to compliance with requirements, provide one of the following:

    a. “AEA-92 and Air Mix 200”, Euclid Chemical Co.
    b. “MB-VR or MB-AE”, Master Builders, Inc.
    c. “Sika AER”, Sika Corp.

2. Air-Entraining admixtures shall not be used in slab mixes, on-grade or elevated.

C. Water-Reducing Admixture: ASTM C 494, Type A, and containing not more than 0.05 percent chloride ions.

1. Subject to compliance with requirements, provide one of the following:

a. "Eucon WR-75 or Eucon WR-91", Euclid Chemical Co.
b. "Pozzolith Normal", Master Builders, Inc.
c. "Plastocrete 160", Sika Corp.

D. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G and containing not more than 0.05 percent chloride ions.

1. Subject to compliance with requirements, provide one of the following:

a. "Eucon 37", Euclid Chemical Co.
b. "Rheobuild 1000", Master Builders, Inc.
c. "Sikament 300", Sika Corp.

E. Water-Reducing, Accelerating Admixture: Non-chloride, non-corrosive per ASTM C 494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from and independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.

1. Subject to compliance with requirements, provide one of the following:

a. "Accelguard 80", Euclid Chemical Co.
b. "Pozzutec 20", Master Builders, Inc.

F. Water-Reducing, Retarding Admixture: ASTM C 494, Type D and contain not more than 0.05 percent chloride ions.

1. Subject to compliance with requirements, provide one of the following:

a. "Eucon Retarder 75", Euclid Chemical Co.
b. "Pozzolith Retarder", Master Builders, Inc.
c. "Plastiment", Sika Corporation.

G. Shrinkage Compensating Cement: ASTM C845, Type K, M, or S.

1. Contractor may substitute shrinkage compensating cement concrete for slabs, on grade or elevated, and eliminate all control joints. Design mixes shall be submitted for approval.

H. Certification: Written conformance to the above-mentioned requirements and the chloride ion content of admixtures will be required from the admixture manufacturer prior to mix design review by the Architect.

I. Prohibited Admixtures: Calcium chloride or admixtures containing more than 0.05 percent

chloride ions are not permitted.

2.3 PROPORTIONING AND DESIGN MIXES

A. Proportion mixes by either laboratory trial batch or field experience methods as specified in ACI 301, using materials to be employed on the project for each class of concrete required.

B. Submit written reports to Architect of each proposed mix for each type of concrete at least 15 days prior to start of Work. Indicate with each mix design the items or structures for which it is to be used. Do not begin concrete production until mixes have been reviewed by Architect. Submit the following information:

1. Complete identification of aggregate source of supply.
2. Tests of aggregate for compliance with specified requirements.
3. Scale weight of each aggregate.
4. Absorbed water in each aggregate.
5. Brand, type, and composition of cement.
6. Brand, type, and amount of each mixture.
7. Amounts of water used in trial mixes.
8. Proportions of each material per cu. yd. including fibrous secondary reinforcement.
9. Gross weight and yield per cu. yd. of trial mixtures.
10. Measured slump.
11. Measured air content.
12. Compressive strength developed at 7 days and 28 days, from not less than 3 test cylinders cast for each 7 and 28 day test, and for each design mix. These test reports may be from previous projects within the past 6 months.
13. Identification number or name of mix to verify agreement with compression test reports.

C. Water-Cement Ratio Methods: Concrete proportions may be established by use of Water-Cement Ratio Limits Table 5.4 and limiting restrictions in ACI 301.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Architect before using in work.

E. Maximum Water Cement Ratio: Concrete mixes shall be limited to those shown on the contract documents. Mixes shall comply with chapters 3, 4 and 5 of ACI 318 latest building code adopted edition.

Super plasticizers, flyash, and water reducers shall be used to obtain required slump while maintaining maximum water-cement ratio.

F. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs, and sloping surfaces: Not more than 4 inches
2. Reinforced foundation systems: 4 inches, +/- 1 inch
3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2-to-3-inch slump concrete.

4. Other concrete: Per Structural Drawings
5. Other concrete: Slump for regular concrete subject to vibratory compaction should be 4" plus/minus 1". Refer to see ACI 301-96, Section 4.2.2.2; also, ACI A-117, Section 2.5.1.

G. Adjustment to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work. Adjustments must be made in writing to the Architect. Only proceed when approval is granted.

H. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to the Architect for preparing and reporting proposed mix designs. Trial batch and field experience tests shall have been performed within 12 months of submittal date.

2.4 RELATED MATERIALS

A. Rubber Waterstops: Corps of Engineers CRD-C 513.

5. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

a. Progress Unlimited.
b. Williams Products, Inc.
c. Synko Flex, Henry Products

B. Sand Cushion: Clean, manufactured or natural sand.

C. Preformed Expansion Joint Fillers: Reflex by The JD Russell Company or other expansion joint filler made of Recycled rubber (tires).

2.5 CONCRETE CURING MATERIALS

A. Moisture-Retaining Cover: One of the following, complying with ANSI-ASTM C171 for concrete floors that are to be exposed or to receive floor sealer. Contractor's option to obtain specified requirements for concrete slabs-on-grade. Coordinate uses with finish material manufacturer's specifications.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

B. Water Based Acrylic Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class B, with 18 to 20 percent minimum solids.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Safe Cure and Seal (J-18), Dayton Superior Corp.

b. Aqua-Cure VOX, Euclid Chemical Co.
c. Kure-N-Seal, WB, Degussa Building Systems
d. Spartan Coate WBII, The Burke Group.

C. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Eucobar, Euclid Chemical Co.
b. E-Con, L&M Construction Chemicals, Inc.
c. Confilm, Degussa Building Systems
d. Finishing Aid, The Burke Group.

D. Concrete curing materials shall be approved by the manufacturer of the product for the final finish on the concrete slabs. Submit written approval/certification.

2.6 SELF-LEVELING UNDERLAYMENT

A. Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1 inch thick to feathered edges. (If required for patching and repairing).

1. Compressive strength: 4100 psi minimum at 28 days
2. Flexural strength: 1300 psi at 28 days
3. Tensile strength: 750 psi at 28 days
4. Shrinkage: .025 after 7 days

B. Manufacturers:

1. "Thoro Underlayment": Thoro System Products, Centerville, Indiana.
2. "Ardex K-15": Ardex, Inc. Pittsburgh, Pennsylvania.
3. “300 Premium Underlayment”: The Burke Group, Converse, Texas.

2.7 CONCRETE UNDERLAYMENT

A. One-component, cement-based trowel grade underlayment. (If required for patching and repairing).

1. Compressive strength: 4250 psi minimum at 28 days
2. Flexural strength: 1000 psi minimum at 28 days
3. Tensile strength: 650 psi minimum at 28 days

B. Manufacturer:

1. "Thoro Underlayment Trowel Grade": Thoro System Products, Centerville, Indiana.
2. “Burke Feather Patch”: The Burke Group, Converse, Texas.

2.8 BONDING AGENT

A. Chemical Bonding Agent: Film-forming, freeze-thaw resistant compound suitable for brush or spray application complying with MIL-B-19235. Subject to compliance with requirements, provide one of the following:

1. Adbond (J40); Dayton Superior Corp.
2. Eucoweld; Euclid Chemical
3. Everbond; L & M Construction Chemicals
4. Thorobond; Degussa Building Systems
5. Intralok; W.R. Meadows, Inc.
6. Acrylic Bondcrete, The Burke Group

2.9 CONCRETE PATCHING COMPOUND

A. Single-component, cement based, polymer modified patching mortar with low slump properties.

B. Chemical Bonding Agent: Film-forming, freeze-thaw resistant compound suitable for brush or spray application complying with MIL-B-19235. Subject to compliance with requirements, provide one of the following:

1. V/O Patch CI – US MIX Co. 112 South Santa Fe Dr. Denver, CO 80223 www.usspec.com
2. Cement All – CTS Cement Manufacturing Corp. 12442 Knot St. Garden Grove, CA 92841 www.CTScement.com
3. MasterEmaco N 425 – BASF 889 Valley Park Dr. Shakopee, MN 55379 www.master-builders-solutions.basf.us

2.10 ADMIXTURES, GENERAL

A. Use air-entraining admixture in exterior concrete, unless otherwise indicated. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement having air content within the following limits:

1. Concrete structures and slabs exposed to freezing and thawing or subjected to hydraulic pressure:

a. 3 to 15 percent for maximum 2 inches aggregate.
b. 4-1/2 percent to 6-1/2 percent for maximum 1-inch aggregate.
c. 5 to 7 percent for maximum 3/4-inch aggregate.
d. 6 to 8 percent for maximum 1/2-inch aggregate.

2. Other Exterior Concrete: 2 to 4 percent

B. Use of admixtures for water-reducing and set-control shall be permitted only with prior approval of the Architect for each condition and shall be in strict compliance with the manufacturer's directions.

1. Design mix submittals shall include these admixtures and shall indicate for which types of concrete structures they are to be used.

C. Use amount of admixtures s recommended by manufacturer for climatic conditions prevailing at

time of placing. Adjust quantities and types of admixtures as required to maintain quality control.

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

1. When air temperature is between 85 deg F and 95 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 95 deg F, reduce mixing and delivery time to 60 minutes.
2. Delete the references for allowing additional water to be added to the batch for material with sufficient slump. Addition of water to the batch will not be permitted.
3. During hot weather or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 PREPARATION

A. Pre-placement Inspection: Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit the installation of their work; cooperate with other trades in setting such work, as required.

1. Inspect soil at bottom of foundation systems which will be subject to testing for soil bearing value by the testing laboratory, as directed by the Architect. Place concrete immediately after approval of foundation excavations.
2. Inspect underslab drainage course areas that were subject to testing for soil bearing value by the testing laboratory as required by Architect. Place concrete immediately after approval of underslab compaction tests.

B. Material placement for interior slabs on grade and exterior concrete stoops.

1. Under building slabs at wood floor areas, use satisfactory excavated or borrow material to 6 inches below concrete then use drainage fill material and moisture barrier to bottom concrete.
2. Under remaining building slabs use satisfactory excavated or borrow material to 8 inches below concrete; then place and compact 4 inches of drainage fill material; then place vapor barrier, lapping joints and 6 inches minimum and seal with tape or mastic, lap and fold joints and turn membrane up on walls to top of floor. Do not puncture membrane. Vapor barrier not required for walks and slabs. Then place and compact top 4 inches of drainage to fill bottom of concrete.
3. Install and properly anchor the slab reinforcing mesh.
4. Position waterstops and expansion joint fillers where indicated on the Drawings and as recommended by manufacturer. Special precautions shall be taken to avoid collapse

during installation.

3.3 JOINTS

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.

1. Construction joints to be per FBC and ACI 318; cleaned, laitance removed, wetted, standing water removed.

B. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

F. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Joint fillers and sealants are specified in Division 07.

G. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8-inch-wide by one-fourth of slab depth or inserts 1/4-inch-wide by one-fourth of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
3. If joint pattern is not shown, provide joints not exceeding 12 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
4. Joint fillers and self-leveling sealants are specified in Division 07.

H. Expansion Joints

1. Provide pre-molded joint filler for expansion joints abutting concrete curbs (except in integral walk and curb), catch basins, manholes, inlets, structures, masonry walls, and other fixed objects.
2. Set and secure continuous expansion joint strips where edge of slab abuts vertical surfaces.
3. Locate expansion joints at 30 feet o.c. for walks and curbs, unless otherwise shown.

4. Extend joint fillers full-width and depth of joint, flush with finished surface. Furnish joint fillers in one-piece lengths for the full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together. Form top edge of filler to conform to top profile of concrete.

3.4 INSTALLING EMBEDDED ITEMS

A. Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.

C. Install dovetail anchor slots in concrete structures as indicated on drawings.

D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.5 PREPARING FORM SURFACES

A. Coat contact surfaces of forms with an approved, non-residual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

1. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.6 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

1. Concreting shall be carried on at such a rate that at all times the concrete is at all times plastic and flows readily into spaces between reinforcement.
2. Prohibit the following concrete

a. Partially hardened concrete
b. Contaminated concrete
c. Re-tempered concrete
d. Concrete that has been re-mixed after it has taken its initial set

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

a. Depth of concrete on composite metal deck elevated slabs shall be performed or checked by dip stick method only. Use of lasers is not allowed and strictly prohibited.

3. Maintain reinforcing in proper position on chairs during concrete placement.
4. Use of self-propelled power (laser) screed equipment is not acceptable on elevated slabs on metal deck, and is strictly prohibited.

F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 95 deg F. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth-Rubbed Finish: Provide smooth-rubbed finish on scheduled concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.

1. Combine one part portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard portland cement and white portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 MONOLITHIC SLAB FINISHES

A. General Information (Slabs on Grade): The requirements indicated are based upon the latest FF/FL method. Bids for this work shall reflect these requirements and enforcement thereof can be expected.

B. Typical Corridors, Normal Sized Rooms:

1. Specified Overall Value: FF 30/FL 23
2. Minimum Local Value: FF 25/FL 20
3. Apply trowel finish to slab surfaces that are to be covered with resilient flooring, paint, or other thin film finish coating system.

C. Large Rooms and Public Areas:

1. Specified Overall Value: FF 36/FL 25
2. Minimum Local Value: FF 30/FL 22
3. Apply trowel finish to monolithic slab surfaces that are to receive resilient flooring, carpet, or other thin finish system.

D. High Tolerance Floors where indicated:

1. Specified Overall Value: FF 50/FL 30
2. Minimum Local Value: FF 40/FL 25
3. Apply trowel finish to slab surfaces that are to be covered with wood flooring, paint, or other thin finish coating system.

E. Nonslip Broom Finish (NsBrm-Fn): Apply nonslip broom finish to exterior concrete with fiber bristle broom, perpendicular to main traffic route. Coordinate required final finish with the Architect before application.

F. Elevated slabs shall have a specified overall value of FF 22 to FF 27 and a minimum local of FF 20 with no FL number defined.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.10 CONCRETE CURING AND PROTECTION

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing.

C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified. Curing methods are contractor's option to obtain finishes as required. Coordinate curing method with floor finish manufacturer. Do not use certain methods as may be required by the floor finish manufacturer. Moist cure methods are highly recommended.

D. Provide moisture curing by the following methods:

1. Keep concrete surface continuously wet by covering with water for not less than 72 hours.
2. Use continuous water-fog spray.
3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.

E. Provide moisture-retaining cover curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover,

unless otherwise directed.

2. Concrete floor surfaces scheduled to receive tile installations shall have been moist cured; curing of these surfaces by sprayed chemical curing compounds is not permitted.

3.11 SHORES AND SUPPORTS

A. Comply with ACI 347 for shoring and reshoring in multistory construction, and as specified.

B. Extend shoring from ground to roof for structures four stories or less, unless otherwise permitted.

C. Extend shoring at least three floors under floor or roof being placed for structures over four stories. Shore floor directly under floor or roof being placed, so that loads from construction above will transfer directly to these shores. Space shoring in stories below this level in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members where no reinforcing steel is provided. Extend shores beyond minimums to ensure proper distribution of loads throughout structure.

D. Remove shores and re-shore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate re-shoring to support work without excessive stress or deflection.

E. Keep re-shores in place a minimum of 15 days after placing upper tier, or longer, if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

3.12 REMOVING FORMS

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the Work, may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.13 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not

use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.14 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01-inch-wide or that penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycombs, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.
4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished

concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

F. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

G. Repair methods not specified above may be used, subject to acceptance of Architect.

3.15 UNDERLAYMENTS

A. Install in strict accordance with manufacturer's written installation instructions and provide primers as recommended.

END OF SECTION 03 30 00

SECTION 03 35 43
POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Concrete Staining.
2. Concrete Densifier.
3. Concrete Sealer.
4. Concrete Repair and protection materials.
5. Concrete Polishing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Cast-in-place concrete subcontractor.
e. Polished concrete finishing Subcontractor.
f. Review of sample panels.
g. Discuss repair procedures for concrete damaged after finishing operations.

2. Review cold- and hot-weather concreting procedures, curing procedures, construction joints, concrete repair procedures, concrete finishing, and protection of polished concrete.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.

C. Samples for Initial Selection: For each type of product requiring color selection.

D. Samples for Verification: For each type of exposed color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Repair materials.
2. Liquid floor treatments.

1.6 QUALITY ASSURANCE

A. Field Sample Panels for polished concrete: After approval of verification sample and before casting concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches minimum, to demonstrate the expected range of finish, color, and appearance variations, sample panel shall include repair materials installed and finished to show final finished appearance where repair of concrete is required.

1. Locate panels as indicated or, if not indicated, as directed by Architect.
2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
3. Demolish and remove field sample panels when directed.

B. Mockups for polished concrete: Before casting concrete, build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship, Mock-up shall include repair materials installed and finished to show final finished appearance where repair of concrete is required. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Demonstrate curing, finishing, and protecting of polished concrete.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 STAIN MATERIALS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Scofield Formula One Liquid Dye, or a comparable product by one of the following:

1. AmeriPolish.
2. H&C® Decorative Concrete Products; a brand of Sherwin-Williams Co.

B. Color: as indicated on the Interior Finish Schedule.

2.2 DENSIFIER AND SEALER MATERIALS

A. Lithium Based Densifier, liquid Floor Treatments for Polished Concrete.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Scofield Formula One Lithium Densifier MP, or a comparable product by one of the following:

a. Advanced Floor Products.
b. Euclid Chemical Company (The); an RPM company.

B. Waterborne Concrete Sealer Floor Treatments for Polished Concrete.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Scofield Formula One Guard-W, or a comparable product by one of the following:

a. Advanced Floor Products.
b. Euclid Chemical Company (The); an RPM company.

2.3 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. FLOOR PROTECTION

1. Multi-ply, textured membrane laminated with non-woven polypropylene geotextile.

a. Basis of Design (BOD) Product: Subject to compliance with requirements, provide Scofield “Proguard Duracover” Floor Protection system or comparable product by one of the following manufacturers:

1) Pro-Tech.
2) Surface Protection International.
3) Shield n Peel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare concrete in accordance with Manufacturer’s requirements.

B. Repair concrete surfaces with repair materials as specified so concrete can be ground flush to level as specified. Install repair materials in accordance with Manufacturers requirements.

C. Grind or open the surface of concrete to a level 2 for Cut Depth/ Grind.

D. Remove dust by Vacuum.

3.2 STAINING

A. Newly placed concrete shall be at least 30 days old before staining.

B. Allow concrete surface to dry before applying stain. Verify readiness of concrete to receive stain according to ASTM D4263 by tightly taping 18-by-18-inch, 4-mil-thick polyethylene sheet to a representative area of concrete surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.

C. Stain: Apply penetrating stain to concrete surfaces according to manufacturer's written instructions.

D. Allow surfaces to dry.

E. Remove surplus dye. Use rotary equipment with stiff bristle brushes or fine honing 800 grit abrasives to remove excess dye and expose desired aggregate surfaces.

F. Repeat Procedure to achieve finish matching approved sample panel.

3.3 DENSIFIER APPLICATION

A. Newly placed concrete shall be at least 28 days old before applying densifier.

B. Prepare surfaces according to manufacturer's written instructions.

C. Allow concrete surface to dry before applying densifier.

D. Apply densifier as a flood coat to wet film as recommended by the Manufacturer, to concrete surfaces according to manufacturer's written instructions for the period of time as recommended.

E. Remove excess densifier by means as recommended by the Manufacturer once cure time has elapsed.

3.4 SEALER APPLICATION

A. Prepare surfaces according to manufacturer's written instructions and as follows:

B. Allow concrete surface to dry before applying sealer.

C. Apply sealer as a flood coat to wet film as recommended by the Manufacturer, to concrete surfaces according to manufacturer's written instructions for the period of time as recommended.

D. Remove excess sealer by means as recommended by the Manufacturer once cure time has elapsed.

3.5 POLISHING

A. Polish: Level 3: Semi-Polished, 800 grit.

B. Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.

1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
3. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
4. Control and dispose of waste products produced by grinding and polishing operations.
5. Neutralize and clean polished floor surfaces.

3.6 FLOOR PROTECTION AND REPAIR OF FINISHED FLOORS

A. Protect floors in accordance with Manufacturers requirements with product specified.

B. Floors damaged after finished shall repaired in accordance with the Manufacturers requirements. Appearance shall be performed in accordance with repairs of approved sample panels. Final appearance of repairs shall be approved by the Architect.

END OF SECTION 03 35 43

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SECTION 03 41 00
STRUCTURAL PRE-CAST CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Provide labor, materials and equipment necessary to fabricate, transport and install structural pre-cast concrete elements and accessories indicated on the Drawings and specified herein.

1. Columns and bearing saddles
2. Beams, spandrels, and girders
3. Grout packing
4. Connection devices.
5. Bearing pads.

1.2 SUBMITTALS

A. Submit in accordance with Division 1 requirements.

1. All structural pre-cast concrete shop drawings shall be certified and sealed by a Structural Engineer registered in the State of Florida.

B. Product Data: Submit manufacturer's specifications, data and instructions for manufactured materials and products. Include manufacturer's certifications and laboratory test reports as required.

C. Shop Drawings: Submit shop drawings showing complete information for fabrication and installation of pre-cast concrete units. Indicate member dimensions and cross-section; location, size and type of reinforcement, including special reinforcement and lifting devices necessary for handling and erection.

1. Include erection procedure for pre-cast units, sequence of erection, and required handling equipment.
2. Show layout, dimensions and identification of each pre-cast unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS standard symbols. Detail inserts, connections, and joints, including accessories and construction at openings in pre-cast units.
3. Show location and details of anchorage devices that are to be embedded in other construction.

D. Shop drawings shall be Signed and sealed by a Structural Engineer registered in the State of Florida, stating that the design loads, calculations, designated standards, and codes and regulations have been met in accordance with the Contract Documents.

1.3 QUALITY ASSURANCE

A. Pre-cast Concrete Units: Comply with recommended practices and procedures of:

1. ACI 301 - Structural Concrete for Buildings
2. ACI 318 - Building Code Requirements for Reinforced Concrete
3. ANSI/AWS D1.1 - Structural Welding Code - Steel
4. ANSI/AWS D1.4 - Structural Welding Code - Reinforcing Steel
5. ASTM A416 - Uncoated Seven-Wire Stress-Relieved Strand for Pre-stressed Concrete.
6. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
7. ASTM C150 - Portland Cement
8. PCI MNL-116 - Manual for Quality Control for Plants and Production of Pre-cast and Pre-stressed Concrete Products.
9. PCI MNL-120 - Design Handbook – Pre-cast and Pre-stressed Concrete
10. PCI MNL-123 - Manual on Design of Connections for Pre-cast Pre-stressed Concrete
11. PCI MNL-124 - PCI Design for Fire Resistance of Pre-cast Pre-stressed Concrete.
12. UL - Underwriter's Laboratories

B. Fabricator Qualifications: Firms that have a minimum of 5 years successful experience in the fabrication of pre-cast concrete units, similar to units required for this project, will be acceptable. Fabricator must have sufficient production capacity to produce, transport, and deliver required units without causing delay in the Work.

C. Design modifications may be made only as necessary to meet field conditions and to ensure proper fitting of the work, and only as acceptable to Architect. Maintain general design concept shown without increasing or decreasing sizes of member or altering profiles and alignment shown. Provide complete design calculations and Drawings prepared by a Registered Professional Engineer, if requested by Architect, if design modifications are anticipated.

D. Qualifications of Erector: Firms that have a minimum of 5 years successful experience in the erection of architectural pre-cast concrete units, similar to units required for this Project, will be acceptable.

E. Qualification of Welder: Qualified within previous 12 months in accordance with ANSI/AWS D1.1. and ANSI/AWS D1.4

1.4 DESIGN REQUIREMENTS

A. Size architectural/structural pre-cast concrete components to withstand design loads as follows:

1. Horizontal Loads: 40 lb/sq.ft., wind on vertical projections.
2. Vertical Loads: 100 lb/sq.ft., live load loads.
3. Horizontal at Rail Top: 20 lb./ft.

B. Maximum Allowable Deflection: 1/360 span.

C. Design members exposed to the weather to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

D. Design system to accommodate construction tolerances, deflection of other building structural members, and clearances of intended openings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site.

B. Store and protect products.

C. Handle pre-cast members in position consistent with their shape and design. Lift and support only form support points.

D. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation and erection.

E. Protect members to prevent staining, chipping, or spalling of concrete.

F. Mark each number with date of production and final position in structure.

1.6 SEQUENCING AND SCHEDULING

A. Sequence work under the provisions of Division 1 requirements.

B. Schedule work under the provisions of Division 1 requirements.

C. Coordinate work under the provisions of Division 1 requirements.

D. Coordinate the work of framing components not pre-tensioned but associated with the work of this Section.

PART 2 – PRODUCTS

2.1 FORMWORK MATERIALS

A. Accurately construct forms, mortar-tight, and of sufficient strength to withstand pressures due to concrete placing operations, temperature changes and when pre-stressed, pre-tensioning and de-tensioning operations. Maintain formwork to provide complete pre-cast concrete units of shapes, lines and dimensions indicated, within specified fabrication tolerances.

B. Unless forms for plant-manufactured pre-stressed concrete units are stripped prior to de-tensioning, design forms so that stresses are not included in pre-cast units due to deformation of concrete under pre-stress or to movement during de-tensioning.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 60, unless otherwise indicated.

B. Low-Alloy Steel Reinforcing Bars: ASTM A706.

C. Steel Wire: ASTM A1064, plain, cold-drawn, steel.

D. Welded Wire Fabrication: ASTM A1064.

E. Welded Deformed Steel Wire Fabric: ASTM A1064.

2.3 PRESTRESSING TENDONS

A. Uncoated, 7-wire stress-relieved strand complying with ASTM A416. Use Grade 250 or Grade 270.

B. Strand similar to above, but having size and ultimate strength of wires increased so that ultimate strength of the strand is increased approximately 15 percent, or strand with increased strength but with fewer number of wires per strand, may be used at manufacturer's option and with approval of the Architect. Obtain Architect's approval.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type I or Type III.

1. Use only one branch and type of cement throughout the Project, unless otherwise acceptable to Architect.
2. Use standard "gray" portland cement for back-up concrete.
3. Use "white" or colored portland cement on exterior exposed surfaces of panels. Facing concrete shall be 1-inch thick minimum.

B. Coarse Aggregate: ASTM C33; hard, durable, carefully selected and graded; free of materials causing staining or reacting with cement.

1. Use aggregate from same source as those used in Architect's control sample.

C. Fine Aggregate: ASTM C33; manufactured sand of same material as coarse aggregate, unless otherwise acceptable to Architect.

D. Water: Potable or free from foreign materials in amounts harmful to concrete and embedded steel.

E. Air-Entraining Admixture: ASTM C260.

F. Water-Reducing Admixture: ASTM C494; Type A.

G. Calcium Chloride: Use calcium chloride in pre-cast pre-stressed concrete is not permitted.

2.5 BEARING PADS

A. Provide bearing pads for pre-cast concrete units as indicated on the Drawings.

B. Use one of the following as recommended by the pre-cast manufacturers and as approved by the Architect.

1. Elastomeric Pads: Vulcanized, chloroprene elastomeric compound, molded to size or cut from a molded sheet, 50-60 Shore A durometer.
2. Laminated Fabric-Rubber Pads: Preformed, unused synthetic fibers and new, unvulcanized rubber. Surface hardness of 70-80 Shore A durometer.

3. Frictionless Pads: TFE with glass fiber reinforcing as required for service load bearing stress.

C. Pre-cast manufacturer is responsible for providing appropriate pads for the appropriate use and locations.

2.6 CONNECTION MATERIALS

A. Steel Plates: Structural quality, hot-rolled carbon steel, ASTM A283, Grade C.

B. Steel Shapes: ASTM A36.

C. Anchor Bolts: ASTM A307, low-carbon steel bolts, regular hexagon nuts and carbon steel washers.

D. Finish of Steel Units: Exposed units galvanized per ASTM A153; others painted with rust-inhibitive primer.

E. Inserts: As manufactured by Heckman Building Products, Inc., Chicago, Illinois.

2.7 GROUT MATERIALS

A. Cement Grout: Portland cement, ASTMC150, Type I, and clean, natural sand, ASTM C404. Mix at ratio of 1.0-part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.

B. Non-Metallic Shrinkage-Resistant Grout: Premixed, nonmetallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with Corps of Engineers CRD-C558, Type A. Minimum yield strength of 10,000 psi at 28 days.

2.8 BUILT-IN MATERIALS

A. Dovetail Anchor Slots: Shall be No. 100-B small dovetail anchor slots, 20 gage galvanized steel, as manufactured by Heckman Building Products, Inc., 4015 W. Carroll Avenue, Chicago, Illinois 60624.

2.9 PROPORTIONING AND DESIGN OF MIX

A. Design mixes may be prepared by an independent testing facility or by qualified pre-cast manufacturing plant personnel, at pre-cast manufacturer's option.

B. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the Project for each type of concrete required, complying with ACI 211.1 or ACI 211.2.

C. Standard Mix: Standard-weight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties:

1. Compressive Strength: 5,000 psi minimum at 28 days.

2. Total Air Content: Not less than 4 percent nor more than 6 percent.

D. Admixtures: Use air-entraining admixture in strict compliance with manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low-slump concrete, may be used subject to Architect's acceptance.

1. Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

2.10 FABRICATION

A. Fabricate pre-cast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116, unless otherwise indicated.

B. Fabricate units straight, and true to size and shape, with exposed edges and corners precise and square unless otherwise indicated.

1. Pre-cast units which are warped, cracked, broken, spalled, stained, or otherwise defective will not be acceptable.

C. Built-In Items: Provide reglets, slots, holes, and other accessories in units to receive anchors, dowels, reglets, waterstops, flashings, and other similar work as indicated.

D. Anchorages: Provide loose steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other miscellaneous steel shapes not provided by other trades, necessary for securing pre-cast units to supporting and adjacent members.

E. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated on the shop drawings.

2.11 FINISHING

A. Ensure exposed-to-view finish surfaces of pre-cast concrete members are uniform in color and appearance.

B. Cure members under identical conditions to develop required concrete quality, and minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

C. All structural pre-cast concrete exposed to the interior of the building shall be smooth trowel finish with no small surface holes, chips, spalling, or imperfections.

2.12 TOLERANCES

A. Conform to PCI MNL-116.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erector must examine supporting structure and conditions under which precast concrete work is to be erected and notify Contractor in writing of conditions detrimental to proper and timely completion of Work. Do not proceed with installation of architectural precast concrete units until unsatisfactory conditions have been corrected in a manner acceptable to Erector. Beginning of installation indicates that installer accepts existing conditions.

3.2 INSTALLATION

A. Deliver anchorage items which are to be embedded in other construction before start of such Work. Provide setting diagrams, templates, instructions, and directions as required for installation.

B. Do not install pre-cast units until concrete has attained its design compressive strength.

C. Install pre-cast concrete members plumb, level, and in alignment within PCI MNL-27 specified limits of erection tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment as members are being permanently connected.

1. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.

D. Accessories: Install clips, hangers, and other accessories required for erection of pre-cast units to supporting members and back-up materials.

E. Anchor units in final position by bolting, welding, grouting, or as otherwise indicated. Remove temporary shims, wedges, and spacers as soon as possible after anchoring is completed.

1. At bolted connections use lock washers or other acceptable means to prevent loosening of nuts.

2. At welded connections apply rust-inhibitive coating on damaged areas, same as shop-applied material. Use galvanizing repair coating on galvanized surfaces.

F. Sealant shall be installed in joints in accordance with sealant manufacturer's recommendations.

1. Comply with requirements for elastomeric sealants specified in Section 07920.

G. Cleaning: Clean exposed facings to remove dirt and stains which may be on units after erection and completion of joint treatments. Wash and rinse in accordance with pre-cast manufacturer's recommendations. Protect other work from damage due to cleaning operations. Do not use cleaning materials or processes which could change the character of exposed concrete finishes.

H. Erection Tolerances:

1. Erect members level and plumb within allowable tolerances.
2. Conform to PCI MNL-116.

I. Protection:

1. Protect members from damage caused by field welding or erection operations.

2. Provide non-combustible shields during welding operations.

3.3 PERFORMANCE REQUIREMENTS

A. Conduct inspections, perform testing, and make repairs or replace unsatisfactory precast units as required.

1. Limitations as to the amount of patching which will be permitted is subject to acceptance by the Architect.

B. In addition to above, in-place pre-cast in units may be rejected for any one of the following:

1. Exceeding the specified installation tolerances.
2. Damaged during construction operations.
3. Exposed-to-view surfaces which develop surface finish deficiencies.
4. Other defects as listed in PCI MNL-116.

END OF SECTION 03 41 00

SECTION 03 41 13
PRECAST CONCRETE HOLLOW CORE PLANKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes precast concrete hollow-core planks.

B. Two-hour U.L. rated construction at roof assembly

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and instructions for manufactured materials and products.

B. Shop Drawings:

1. Indicate member dimensions and cross-section, location, size and type of reinforcement, including special reinforcement for handling and erection.
2. Indicate details of inserts, hangers, joints, grouting connections, including accessories and construction at openings.
3. Include manufacturer's standard and special loading chart data for span and conditions required. Include setting plans and anchorage details.
4. Shop drawings shall be certified by an Engineer registered in the State of Florida, stating that the testing loads, design criteria and designated standards have been met.
5. All shop drawings shall be signed and sealed by a Registered Engineer, licensed in the State of Florida.

C. PCI Certification

D. Pre-Installation meeting minutes

1.3 QUALITY ASSURANCE

A. Design planks in accordance with the requirements of:

1. PCI MNL-120 – Design Handbook.
2. PCI MNL-126 – Manual for the Design of Hollow Core Slabs.
3. PCI MNL-124 – Design for Fire Resistance of Precast Prestressed Concrete.
4. ACI 318.
5. ACI 301.

B. Design connections in accordance with PCI MNL-123 – Manual on Design of Connections for Precast Prestressed Concrete.

C. Design planks under direct supervision of a professional engineer experienced in design

of this work and licensed in the State of Florida.

D. Produce planks in accordance with requirements of PCI MNL-116. Maintain plant records and quality control program during production of precast planks. Make records available upon request.

E. Maintain one copy of each referenced document applicable to design or fabrication on site.

F. Fabricator Qualifications: Units shall be fabricated by a firm with a minimum of 5 years experience and regularly engaged in the manufacturer of precast prestressed hollow slab units.

G. The precast concrete manufacturing plant shall be certified by the Precast/Prestresses Concrete Institute (PCI) Plant Certification Program. Manufacturer shall be certified at the time of bidding. Certification product group and category shall be C2. Submit copy of certification to the Architect for review along with the shop drawing submittals.

H. In general, following is the scope of inspections to be performed on precast concrete in the precast plant, prior to shipping precast units to the project site.

1. Identification, examination, acceptance, and plant testing of materials and sub-assemblies such as steel plates and their anchorages
2. Inspecting and recording of tensioning
3. Inspecting of beds and forms prior to concreting
4. Checking of dimensions of members, number, size, and position of tendons, reinforcing steel, and other incorporated materials, openings, and blockouts
5. Regular inspection of batching, mixing, conveying, placing, compacting, finishing, and curing of concrete
6. Preparation of concrete specimens for testing and performance of tests for slump, air content, and cylinder strength
7. Inspecting operations of detensioning, product removal from beds, handling, and storing
8. Final inspection of finished product prior to shipment. Monitoring dimensions, camber, blockouts, embedments, and finishes
9. General observation of plant equipment, working conditions, weather, and other items which have the potential for affecting the products

I. To establish evidence of proper manufacture and quality of precast and prestressed concrete members, a system of records shall be utilized in each plant which will provide full information regarding the testing of materials, tensioning, concrete proportioning, placing and curing, and disposition of members. These records shall be available for review by the Architect, if required.

1.4 DESIGN REQUIREMENTS

A. Design components to withstand dead loads and live loads in an unrestrained condition:

1. Floor Assembly: 100 lb/sq ft live load
2. Concentrated Loads as indicated on drawings

B. Maximum Allowable Deflection of Roof Planks: 1/240 span

C. Maximum Allowable Deflection of Floor Planks: 1/360 span cambered to achieve flat surface under dead load

D. Design components to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.

E. Fire Resistance: Provide designs tested to provide U.L. Fire Resistive Directory ratings as indicated on Architectural Drawings.

1.5 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this Section.

B. Discuss anchor and weld plate locations, sleeve locations, and cautions regarding cutting or core drilling.

1.6 DELIVERY, STORAGE AND HANDLING

A. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation and erection.

B. Mark each member with date of production and final position in structure.

1.7 COORDINATION

A. Coordinate with framing components directly associated with the Work of this Section.

B. Coordinate field cut openings with affected section.

C. Coordinate location of hanger tabs and devices for mechanical and electrical work.

PART 2 - PRODUCTS

2.1 PRECASTERS

A. Products of the following manufacturers are acceptable providing they meet or exceed the requirements of the Drawings and Specifications.

1. Coreslab Structures
2. Gate Pre-cast.
3. Dura-Stress, Leesburg, Florida

2.2 MATERIALS

A. Portland Cement: ASTM C150, Type 3
B. Concrete Materials: ACI 301

C. Aggregates: ASTM C33, and as herein specified. Provide aggregate from a single source for exposed concrete.

1. Local aggregates not complying with ASTM C33, but which have shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to the Architect.
2. Fine Aggregate: Clean, sharp, natural sand free from loam, clay lumps or other deleterious substances.
3. Coarse Aggregate: Clean, un-coated, processed aggregate containing no clay, mud, loam or foreign material, as follows:

a. Crushed stone, processed from natural rock or stone.
b. Washed gravel, either natural or crushed. Use of pit or bankrun gravel is not permitted.
c. Maximum Aggregate Size: Not larger than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear spacing between individual reinforcing bars or bundles of bar.

(1) These limitations may be waived if, in the judgment of the Architect, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids.

D. Water: Clean, fresh, drinkable

E. Air-Entraining Admixture: ASTM C260

F. Reinforcing Bars: ASTM A615, deformed steel

G. Prestressing Tendons: Uncoated, 7 wire stress-relieved strand complying with ASTM A416, Grade 270

H. Cement-Sand Grout: 3000 psi minimum at 28 days

I. Grout Materials: Nonshrink, nonmetallic cement-based grout, refer to Section 05120 – Structural Steel
J. Grout Materials: Nonshrink, nonmetallic cement-based grout conforming to requirements of CRD-C588. The following products are acceptable.

1. Masterflow - 713: Master Builders
2. Five Star Grout: U.S. Grout Corporation
3. Swindress Bond 310: Pullman Swindell
4. Axpandcrete-S: Anti-Hydro Co.

K. Bearing Pads: Manufacturer’s standard

L. Connecting and Supporting Devices: Plates, angles, items cast into concrete, items connected to steel framing members, and inserts: ASTM A36 carbon steel; hot dip galvanized in accordance with ASTM A153.

2.3 DESIGN AND FABRICATION

A. Units shall be of designation as required to support the design loads indicated on the Drawings, including cantilevered ends where indicated and special reinforcing if required.

B. Furnish units which are free from voids or honeycomb, with straight true edges and surfaces.

C. Finish: Normal plant run finish produced in forms that impart a smooth finish to the concrete. Small surface holes caused by air bubbles, normal form joint marks, and minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycomb, or structural defects will be permitted.

D. Fabrication: Manufacture units of concrete materials which will provide a minimum 3500 psi compressive strength at time of initial prestress and a 28-day strength of 5000 psi.

E. Reinforce slab units to resist transporting and handling stresses

F. Dimensional Tolerances: Fabricate hollow slab units to comply with the following fabricated dimensional tolerances:

1. Length: plus or minus 1/2 inch
2. Width: plus or minus 1/4 inch
3. Depth: plus or minus 1/4 inch
4. Position of voids (vertical or horizontal): plus or minus 1/4 inch. e) Position of tendons: plus or minus 1/8 inch
5. Position of handling devices: plus or minus 6 inches
6. Position of weld plates: plus or minus 1 inch
7. Camber deviation from design camber: plus or minus 1/8 inch per 10 feet, but not greater than plus or minus 1/2 inch
8. Differential camber between adjacent members of the same design: 1/4 inch per 10 feet, but not greater than 1/2 inch
9. Squareness of ends (vertical and horizontal alignment): plus or minus 1/4 inch

G. Coordinate required openings in precast hollow core planks with other work.

1. Addition of holes greater than 6” diameter shall be approved by the Engineer of Record involved in the preparation of the shop drawings.

I. Field cut openings 6” diameter and smaller. Coordinate to prevent cutting pre-stressing strands. X-ray as required.

J. All exposed surfaces as a result of field cutting holes shall be finished smooth matching adjacent precast concrete in color, texture, and finish. This is required at all exposed sides of field cut openings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which hollow slab units are to be installed. Do not proceed with the Work until unsatisfactory conditions have been corrected.

1. Verify supporting structure is ready to receive work.

3.2 INSTALLATION

A. Follow erection procedures and sequence of erection as recommended by hollow slab unit manufacturer.

B. Lift, place, and secure hollow slab units in accordance with manufacturer's printed instructions and final shop drawings, keeping units tight and perpendicular to bearing supports. Do not install hollow slab units until supporting members are in place and secured.

C. Align and level by methods, procedures, and equipment as recommended by the manufacturer.

D. Insert hangers into joints from above at locations specified herein.

E. Grout joints and repair damaged surfaces as required. Allow grout to cure prior to placement of topping. Leave units in acceptable condition to receive subsequent work.

F. Grout spaces between underside of slab and top of masonry walls.

END OF SECTION 03 41 13

SECTION 03 45 00
ARCHITECTURAL PRECAST SHAPES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Precast architectural concrete units, including, but not limited to the following:

a. Column caps.
b. Wall Caps

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, data and instructions for manufactured materials and products. Include manufacturer's certifications and laboratory test reports as required.

B. Shop Drawings: Submit shop drawings showing complete information for fabrication and installation of precast concrete units. Indicate member dimensions and cross-section; location, size and type of reinforcement, including special reinforcement and lifting devices necessary for handling and erection.

C. Samples: Submit one Architectural precast sample 2' -0" long.

1. Quality, color, and texture of surface finish.
2. Edge details including chamfers.

PART 2 - PRODUCTS

2.1 FORMWORK MATERIALS

A. Accurately construct forms, mortar-tight, and of sufficient strength to withstand pressures due to concrete placing operations, temperature changes and, when prestressed, pretensioning and detensioning operations. Maintain which will provide complete precast concrete units of shapes, lines and dimensions indicated, within specified fabrication tolerances.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615, latest edition, Grade 60, unless otherwise indicated.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, latest edition, Type I or Type III.

1. Use only one brand and type of cement throughout the Project, unless otherwise acceptable to Architect.

B. Fine Aggregate: ASTM C33, latest edition; manufactured sand of same material as coarse aggregate, unless otherwise acceptable to Architect.

1. Use aggregate size as recommended by the manufacturer so that spalling, chipping, and "popping" will not occur.

C. Water: Potable or free from foreign materials in amounts harmful to concrete and embedded steel.

D. Air-Entraining Admixture: ASTM C260, latest edition.

E. Water-Reducing Admixture: ASTM C494, latest edition; Type A.

F. Calcium Chloride: Do not use calcium chloride in precast concrete.

2.4 PROPORTIONING AND DESIGN OF MIX

A. Design mixes may be prepared by an independent testing facility or by qualified precast manufacturing plant personnel, at precast Manufacturer's option.

B. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the Project for each type of concrete required, complying with the latest editions of ACI 211.1 or ACI 211.2.

C. Standard Mix: Standard-weight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties:

1. Compressive Strength: 5,000 psi minimum at 28 days.
2. Total Air Content: Not less than 4 percent nor more than 6 percent.

D. Admixtures: Use air-entraining admixture in strict compliance with Manufacturer's directions. Admixtures to increase cement dispersion, or provide increased Workability for low-slump concrete, may be used subject to Architect's acceptance.

1. Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

2.5 FABRICATION

A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and following dimensional tolerances, unless otherwise indicated.

B. Molds: Accurately construct molds mortar-tight and of sufficient strength to withstand pressures due to concrete placing operations and temperature changes. Maintain mold work to provide completed precast concrete units of shapes, lines and dimensions indicated, within specified fabrication tolerances.

C. Dimensional Tolerances of Finished Units: Ornamental architectural precast concrete, being tapered by design, is measured for length, width and thickness at the surface from which the mold is loaded maintaining plus or minus 1/16 of an inch tolerance. Overall height and width measured at face adjacent to mold at time of casting:

D. Discard precast architectural concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by Architect.

2.6 FINISHING

A. Ensure exposed-to-view finish surfaces of precast concrete members are uniform in color and appearance.

B. Cure members under identical conditions to develop required concrete quality, and minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

C. Finish shall match Architect's Samples.

D. Color as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install precast concrete members plumb, level and in alignment. Provide temporary supports and bracing as required to maintain position, stability and alignment as members are being permanently connected.

1. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
2. Anchor units in final position by bolting and grouting, or as otherwise indicated or recommended by the manufacturer for installation indicated. Remove temporary shims, wedges and spacers as soon as possible after anchoring and grouting are completed.

B. Accessories: Install mechanical fasteners, hangers and other accessories required for erection of precast units to supporting members and backup materials.

3.3 REPAIRS

A. Repair exposed exterior surfaces of precast architectural concrete units to match color, texture, and uniformity of surrounding precast architectural concrete if permitted by Architect.

B. Remove and replace damaged precast architectural concrete units if repairs do not comply with requirements and if not acceptable to the Architect.

3.4 CLEANING

A. Clean exposed facings to remove dirt and stains on units after erection and completion of joint treatments.

END OF SECTION 03 45 00

SECTION 03 47 13
TILT-UP CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes tilt-up concrete construction, including complete engineering design required relative to erection stresses. In this connection:

1. Neither the Architect nor structural engineer has been retained to design the wall panels for stresses during erection, nor to determine the means and methods to be used for erection and bracing until permanent bracing is in place.
2. Erect the panels in a manner that will be both safe for personnel and property, and to brace and otherwise protect the panels until connections to the permanent structural system are completed.

1.2 SUBMITTALS

A. In addition to requirements of Section 03 30 00, Cast-In-Place Concrete, submit following:

1. Shop Drawings: Submit shop drawings and design calculations to Architect. Show panel dimensions, finish, location of openings, reinforcing steel, anchors, pickup devices and location of strong-backs, pickup reinforcement, connections, bracing system, details, and items furnished by others to be cast into panels.
2. Indicate on Shop Drawings dimensional tolerances and information required for coordination of other trades which interfere with job cast concrete tilt-up wall panels.
3. Shop drawings shall be signed and sealed by the design engineer, licensed in the State of Florida including pickup points and location of strong-backs showing they will withstand all loads to which they are subjected during handling, lifting, stripping and erection operations

B. Casting and Erection Sequence: Submit proposed casting method and sequence of erection to Architect for review not less than 21 days prior to beginning work.

C. Conduct a pre-installation meeting with all affected parties in attendance including the Architect, Structural Engineer and Owner.

D. Coordination Drawings: Indicate <u>all</u> inserts that go into each tilt-up concrete panel including but not limited to, the following:

1. The location of lifting and bracing points, and types.
2. The locations and sizes of the weld plates.
3. Window and door sizes and locations.
4. Thickened portions of the panels.
5. Reveals.
6. All other items in the panels and/or specific panel details and connections required.

E. Shop drawings shall indicate the outside view of the panels as well as the lifting side, or inside view as well. Indicate the location and size of all reveals and special items required on the

outside face. Shop drawings and details shall also show the lifting view, to help reduce errors during the casting process.

F. Quality Control Submittals:

1. Test Reports: When, and as directed by the Architect, submit certified laboratory test reports confirming physical characteristics of materials used in the performance of the Work of this Section.
2. Manufacturer's Instructions: Submit the manufacturer's current recommended methods of installation, including relevant limitations and safety cautions.
3. Mock-up.

G. Product Data: Proposed concrete stain including color chart.

1.3 QUALITY ASSURANCE

A. The following are in addition to Quality Assurance provisions of Section 03 30 00, Cast-In-Place Concrete.

1. Erector Qualifications: At least 5 years of successful experience in erection of tilt-up wall panels similar in size and amount as required for this Project.
2. Qualifications for Production: Contractor shall show evidence of at least 5 years experience in the production of job cast concrete tilt-up panels. Workmen shall be proficient in production operations and shall be under the direct supervision of a competent foreman at all times.
3. Construction Loads: Design and construct tilt-up wall panels to withstand construction loads which may occur during lifting, bracing, and impact by adjoining panels.

B. Perform work in accordance with ACI C4, ACI 318, and ASTM C150.

C. Welding shall conform to AWS D1.1.

D. Qualifications for Welding:

1. Qualifying welding processes and welding operators in accordance with AWS Standard Qualification Procedure.
2. Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification test within the previous 12 months.

E. Design units under the direct supervision of a Structural Engineer experienced in the design of this work and licensed to practice in the State of Florida.

1.4 DESIGN REQUIREMENTS

A. Design units to withstand erection and design loads as calculated in accordance with State and local codes, and erection forces. Calculate structural properties of units in accordance with ACI 301 and ACI 318.

B. Design units to accommodate construction tolerances, deflection of building structural members and clearances of intended openings.

C. Design and size components to withstand wind loads and sway displacement as calculated in accordance with the Florida Building Code 7th Edition (2020).

D. Design component connections to accommodate building movement and thermal movement. Provide adjustment to accommodate misalignment of structure without unit distortion or damage.

1.5 MOCK-UP

A. Construct a 4 foot by 6-foot mock-up of each form liner and finish required at location as directed by the Architect.

1. Include a portion of the sample showing the proposed concrete stain.
2. Include an edge condition and an opening condition.

B. Obtain Architect's approval prior to proceeding with work.

1.6 DELIVERY, STORAGE AND HANDLING

A. Handling Tilt-Up Units: Lift units to position, consistent with their shape and design. Lift and support only from support points.

B. Blocking and Lateral Support During Erection: Clean and non-staining, without causing harm to exposed surfaces. Provide temporary lateral support to prevent bowing, warping, or cracking.

C. Protect units from staining, chipping and spalling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Tilt-up concrete construction materials are specified in Section 03 30 00, Cast-In-Place Concrete.

B. The following are in addition to requirements specified in Section 03 30 00, Cast-In-Place Concrete.

C. Bond Breaker: Polymerized solution containing no oils, waxes, paraffin's, or other material which could affect bond of subsequent finishes or natural appearance of exposed concrete surfaces.

D. Anchors and Inserts: Provide inserts, dowels, bolts, nuts, washers, and other items shown to be cast in panels or required for connecting panels to adjacent work, including inserts required for pickup.

1. Structural Steel Shapes: ASTM A 36.
2. Malleable Iron Castings: ASTM A 47, grade 32510.
3. Carbon Steel Castings: ASTM A 27, grade 60-30.
4. Stainless Steel Anchors: ASTM F 593, mill finish.
5. Hot-Dip Galvanized iron and steel anchors, inserts, and connecting devices: ASTM A 153.

E. Concrete Stain:

1. Basis of Design: Bond-Crete Silicone/Acrylic Concrete Waterproofing, 500 Series by Richards Paint
2. Exterior, pigmented, waterproofing coating

2.2 PANEL MATERIALS

A. Forms:

1. Panel elements shall be cast on a level slab using rigidly constructed well braced steel or wood forms, with precise corners, reveals and arises. Design to withstand stresses resulting from the casting process. Where finish surface is exposed aggregate, do not miter corners.

    a. Coordinate with architectural drawings for any form liner requirements.

2. Forms shall contain block-outs required to provide openings detailed on Drawings.
3. Panels may be stacked for ease of casting in forms as specified above.
4. Bond-Breaker:

    a. Burke Super Bond Breaker
    b. Thompson's C & B.

B. Panel Materials:

1. Cement: Portland cement, conforming to ASTM C 150.
2. Fine and coarse aggregates shall consist of clean, hard, strong, and durable inert material, free of injurious amounts of deleterious substances, conforming to ASTM C 33.
3. Concrete shall be a laboratory design mix approved by Architect.
4. Mixing water shall be free of any acid, alkali, oil or organic material that may interfere with setting of the cement.
5. Admixtures shall be approved by Architect.
6. Miscellaneous metals shall conform to requirements of Section 05 50 00 – Metal Fabrications. Provide all inserts, dowels, and other items to be cast in panels, including inserts required for pick-up. Steel which will be exposed in finished panels shall be hot dip galvanized after fabrication in accordance with ASTM A 123.
7. Panel Inserts: Equal to Burke tapped inserts for casting in panels.

C. Quality of Concrete:

1. Transit mixed concrete shall conform to ASTM C 94.
2. Water cement ratio shall be kept to a minimum, and concrete slump shall not exceed values as indicated on drawings when tested according to ASTM C 143.
3. Water absorption shall be a maximum of 6-1/2 gallons per sack of cement.
4. Concrete shall have a compressive strength as indicated on Drawings at 28 days, when tested on 6-inch diameter by 12-inch high cylinders, according to ASTM C 39.

D. Sacking Materials: Portland cement and water, mixed to a uniform creamy paste.

E. Dry-pack Materials: In accordance with requirements specified in Section 03 30 00 – Cast-In-Place Concrete.

1. Wire Mesh: 2 inches by 2 inches by 16 gage galvanized welded plain wire reinforcing meeting requirements of ASTM A 1064.

2.3 CONCRETE CURING MATERIALS

A. Liquid Membrane-Forming Curing Compound:

1. Liquid type membrane-forming curing compound complying with ASTM C 309, Types I and ID, Class B, unless otherwise approved.
2. Materials selected shall be compatible with other applied finishes. Refer to manufacturer's data for specific requirements.

2.4 TOLERANCES

A. Dimensions of the finished product shall be within the limits recommended by ACI 117, and the following, at the time of placement in the structure.

1. Overall Dimension: Plus or minus 1/8-inch per 10 feet, but not to exceed 3/8-inch within each panel and the finished wall.
2. Cross-Sectional Dimension:

a. Section less than 3 inches: Plus or minus 1/8-inch.
b. Section over 3 inches: Plus or minus 1/4 –inch.

3. Deviations from Straight Line: Not more than 1/4-inch per 20 feet for vertical members; and

Members; and 1/4-inch per 20 feet for horizontal members.

4. Warpage: Not to exceed 1/4-inch per 6 feet. Maximum differential between adjacent units in erected position shall be 3/8 inch.
5. Out-of-Square: Not to exceed 1/8 inch.
6. Location of Anchors and Inserts and Panel Pickup Devices: Not to be more than plus or minus 1/2 –inch from centerline location.

2.5 CONCRETE MIX DESIGN

A. Comply with requirements of Section 03 30 00, Cast-In-Place Concrete.

PART 3 – EXECUTION

3.1 GENERAL

A. Coordinate tilt-up operations with Work of other trades in order that work may be expedited and omissions and delays avoided.

B. Concrete shall also be so handled as to prevent segregation. Mixers, chutes, conveyers, and other handling equipment shall be kept clean and free of foreign matter.

3.2 CASTING OF PANELS

A. Casting Slab Preparation:

1. Casting slab shall be cured and sealed. Saw cuts, cracks, or joints in the casting bed shall be filled and leveled with a sealant so as to minimize transfer of the joint line to the panel face.
2. Waste slabs, if used, shall be of sufficient thickness and strength so as not to crack with the weight of the panels.
3. Contractor shall be responsible for compatibility of curing agents, sealants and releasing agents utilized in the Project. If panels are to be stacked, the troweled surface shall be considered the casting bed and shall be treated as the same.

B. Curing of Base Casting Slabs: Cure concrete surfaces upon which wall panels are to be cast in same manner specified for panels, except do not use paper or other sheet materials. At completion of the 48-hour fog spray curing, use liquid membrane-forming curing compound certified to have qualities as a bond breaker, applied in accordance with manufacturer's instructions.

C. After placing reinforcing steel for panels, check casting slab surfaces for continuity of film. Touch up or recoat worn or damaged areas, taking care to prevent application of coating on reinforcing steel and inserts.

D. Coordinate installation of inserts and anchorages required to be set into concrete slabs prior to casting of panels. Wet setting of embeds shall not be permitted.

1. Where grooves are required in panels, cast grooved side down. Ensure that forming strips are straight and securely fastened to prevent movement or floating during placing operations.

3.3 PLACING CONCRETE

A. Concrete shall be thoroughly compacted during placing and thoroughly worked around reinforcement, around the embedded items, and into corners of the form.

B. During placing vibrate concrete internally with mechanical vibrators in accordance with ACI requirements. Vibrators used shall be "stinger" type or a combination of "stingers" on a traveling screed. Provide one vibrator for each 100 cubic yards of concrete being placed, with one stand-by unit ready for use.

1. Cold joints are not permitted in an individual tilt-up panel.

3.4 CURING AND PROTECTION

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

B. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep panels continuously moist for not less than 72

hours.

C. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

D. Provide liquid membrane curing as follows:

1. Apply membrane-forming curing compound to damp concrete surfaces as soon as the water film has disappeared. Apply uniformly in opposite directions in a two-coat continuous operation by power spray equipment in accordance with the manufacturer's directions. Recoat areas which are subjected to heavy rainfall within three hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period.

3.5 HANDLING AND ERECTION

A. Minimum strength of panels at time of erection shall be as indicated on Structural Drawings. Panels shall not be lifted in less than 10 days after casting unless acceptable to Architect.

B. Prior to commencement of erection operations, check relevant job site conditions insofar as they are ready for the installation of panels. Each element shall be properly marked to correspond with designation on the approved Shop Drawings.

C. Support elements with strongbacks, or by other acceptable means, during storage, handling, hauling, or erection in such a manner as to prevent warpage or cracking.

D. Protect elements at all times to prevent staining.

E. Patch defects in panels, with patching materials matching panel concrete when deemed by the Architect as the appropriate method to correct such defects.

F. Use erection equipment to avoid damage to existing construction, permanent floor slabs, and panels.

G. Set elements in the position assigned on approved erection drawings. Place elements on metal shims, bring to proper level, properly anchor, and dry-pack for the full length of the bearing surface. Remove metal shims when dry-pack has developed sufficient strength to support elements, but not sooner than 7 days after placing dry-pack grout.

H. Panels not attached to the building frame at the time of erection shall be braced in position using a bracing system designed to resist anticipated wind loads with appropriate safety factor.

I. Dry-pack Grout Installation:

1. Preparation Work:

a. Remove laitance down to sound concrete.
b. Surface to receive grout shall be rough and reasonably level.
c. Surface shall have been properly wet cured.
d. Do not use curing compounds.
e. Clean surface of oil, grease, dirt and loose particles.

f. Saturate concrete including bolt holes for 24 hours prior to grouting.
g. Remove free water from concrete and bolt holes immediately before grouting.

2. Formwork shall be compatible with proposed method of placing dry-pack grout. Design for rapid, continuous and complete filling of space to be dry-paced.

a. Build strong, tight forms braced to avoid leakage or buckling under weight of dry-pack.

3. Do not overwork or retemper grout.

J. Panels shall be in final position at least 14 days before panel-to-panel connections are made. Perform welding required to attach panels to building frame and to each other. Comply with AWS code for procedures, appearances and quality of welds, and methods used in correcting weld work.

K. Protection of the erected elements shall be the responsibility of the Contractor.

L. Visible surfaces of the panels, when in place, shall be free from surface defects.

M. Joint Width: Maximum 1 inch and minimum ½ inch.

N. After the panels are erected, dismantle panel pickup devices and patch panels as required for a uniform appearance.

3.6 SEALING OF PANEL JOINTS

A. Clean panel joints of contaminants, including form release agents and concrete laitance. Dust and loose particles shall be blown out with oil-free compressed air and vacuum cleaned.

B. Install fire-resistive blanket where indicated, back-up rod, primer, and sealant in accordance with Section 07 92 00 – Sealants and Caulking.

3.7 FINISHING

A. Apply concrete stain per manufacturer’s instructions after removing foreign materials that would interfere with the performance of the stain.

3.8 PATCHING

E. Patch holes in panel surfaces created by lifting and bracing devices. Comply with concrete surface repair requirements of Section 03 30 00, Cast-In-Place Concrete.

F. Repair of other defective or damaged surfaces will be permitted only upon acceptance by Architect. Remove and replace panels that are not acceptable for surface repairs.

3.9 FIELD QUALITY CONTROL

A. Comply with requirements of Section 03 30 00, Cast-In-Place Concrete.

3.10 ADJUSTING AND PROTECTION

A. Panels damaged during erection, including visible cracks, permanent bowing occurring from erection and spalls, shall be repaired or replaced to the satisfaction of the Architect, structural engineer and other governing agency officials.

B. During the curing period, protect tilt-up concrete from damaging mechanical disturbances, including load stress, heavy shock, excessive vibrations, and damage caused by rain or flowing water. Protect finished concrete surfaces from damage by subsequent construction operations.

END OF SECTION 03 47 13

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SECTION 03 52 16
LIGHTWEIGHT INSULATING CELLULAR CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes lightweight insulating cellular concrete roof system on metal deck.

1.3 SUBMITTALS

A. Product Data and Samples: Product Data: For each type of product indicated. Include mixing and application instructions for each type of lightweight insulating concrete.

B. Shop Drawings: Shop Drawings: Include plans, sections, and details showing roof slopes, lightweight insulating concrete thicknesses, embedded insulation board thicknesses, curbs, roof penetrations, roof drains, roof perimeter terminations, and control and expansion joints.

1. Submit evidence of complying with design requirements. Include Engineering Calculations signed and sealed by the qualified Professional Engineer who was responsible for their preparation.

C. Design Mixtures: For each lightweight insulating concrete mix.

D. Qualification Data for Installer:

E. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Lightweight aggregates.
3. Foaming agents.
4. Admixtures.
5. Molded-polystyrene insulation board.

F. Field Quality-Control Test Reports: Required for all buildings.

G. Minutes: Submit preinstallation minutes as herein indicated.

1.4 QUALITY ASSURANCE

A. Qualification Data: For Installer and testing agency.

B. Applicator must be approved in writing by the manufacturer and shall have a minimum of 5 years' experience installing this type of lightweight insulating concrete roof insulation system.

C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

D. Applicator must be approved in writing by the manufacturer and shall have a minimum of 5 years' experience installing this type of lightweight insulating concrete roof insulation system.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged packages or bulk containers with manufacturer's labels identifying brand, product and UL listing legible and intact.

B. Storage: Store products in a dry location until ready for application in strict accordance with manufacturer's written recommendations.

1.6 FIELD CONDITIONS

A. Do not place lightweight insulating concrete unless ambient temperature is at least 40 deg F and rising.

1. When air temperature has fallen or is expected to fall below 40 deg F, heat water to a maximum 120 deg F before mixing so lightweight insulating concrete, at point of placement, reaches a temperature of 50 deg F minimum and 80 deg F maximum.

B. Do not place lightweight insulating concrete during rain or snow or on surfaces covered with standing water, snow, or ice.

1.7 WARRANTY

A. Furnish a labor and materials endorsement to the roof membrane manufacturer's guarantee confirming that a single guarantee covers both the lightweight insulating cellular concrete system and the roof membrane/flashing system.

1. Refer to Section 07 45 16 "Ketone Ethylene Ester (KEE) Roofing," for roof system guarantee requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide a roof deck assembly for roofing systems identical to those portions of roof assemblies that have been successfully tested by a qualified testing and inspecting agency to withstand the effects of the following.

1. Design Wind Speed: As shown on the Structural Drawings.

B. Reinforcement Criteria: Provide wire reinforcement where required for steep decks, decks acting as structural diaphragms, or fire-rated deck assemblies.

C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory."

D. FM Global Listing: Lightweight insulating concrete along with other roofing components shall comply with requirements in FM Global 4454 as part of a roof assembly, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable.

2.2 CELLULAR LIGHTWEIGHT INSULATING CONCRETE

A. Produce cellular lightweight insulating concrete with the following minimum physical properties using cementitious materials, air-producing liquid-foaming agents complying with ASTM C 869/C 869M, and the minimum amount of water necessary to produce a workable mix:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aerix Industries.
b. Celcore Incorporated.
c. ConcreCel international.
d. Elastizell Corporation of America.

2. As-Cast Unit Weight: 36 to 50 lb/cu. ft. at point of placement, when tested according to ASTM C 138.
3. Oven-Dry Unit Weight: 30 to 40 lb/cu. ft., when tested according to ASTM C 495.
4. Cellular Lightweight Insulating Concrete: R-Value per inch of thickness as indicated:

a. Compressive Strength: Minimum 200 psi when tested according to ASTM C 495

1) Minimum 200 psi compressive strength: R-Value of 1.50 per inch.
2) Minimum 250 psi compressive strength: R-Value of 1.20 per inch.
3) Minimum 300 psi compressive strength: R-Value of 1.00 per inch.

5. Minimum R-Value: As indicated.
6. Per recommendations, no values shall be assigned to crickets and saddle areas due to their relatively small contributory area.
7. Values for Aire-Films, Roof Cover may be added for total calculation.

2.3 MATERIALS

A. Cementitious Material: Portland cement, Type I, ASTM C150.

B. Water: Clean, potable.

C. Foaming Agent: ASTM C 869.

D. Air-Entraining Admixture: ASTM C 260.

E. Molded-Polystyrene Insulation Board: ASTM C 578, Type I, 1.0-lb/cu. ft. minimum density.

1. Provide units with manufacturer's standard keying slots or holes of 3 to 4 percent of board's gross surface area.
2. R-Value: 3.85 per inch thickness.

F. Scupper locations, Molded-Polystyrene Insulation Board: ASTM C 578, Type IX, 2.0-lb/cu. ft. minimum density.

1. Provide units with manufacturer's standard keying slots or holes of 3 to 4 percent of board's gross surface area.
2. R-Value: 4.35 per inch thickness.

G. Sealer: PVA.

H. Water: Clean, potable.

2.4 DESIGN MIXTURES:

A. Prepare design mixtures for each type and strength of lightweight insulating concrete by laboratory trial batch method or by field-test data method. For trial batch method, use a qualified independent testing agency for preparing and reporting proposed mixture designs.

B. Chemical admixtures shall be in compliance with ASTM C 494. Calcium chloride or any admixture containing chloride salts shall not be used in insulating concrete.

2.5 COMPATIBILITY OF PRODUCTS

A. Verify the compatibility of products specified in this Section with products specified elsewhere in the Project Manual. Substitution of components that would restrict or limit the Roof Guarantee will not be accepted.

2.6 ACCESSORIES

A. Provide accessories necessary to comply with manufacturers recommendations and to meet fire resistance and code requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cellular lightweight concrete shall not be installed on painted metal deck.

3.2 MIXING AND PLACING

A. Mix and place lightweight insulating concrete according to manufacturer's written instructions, using equipment and procedures to avoid segregation of mixture and loss of air content.

1. Clean and prepare existing substrates per the recommendations of the manufacturer.
2. Manufacturer's technical representative shall inspect substrates before placement of insulating concrete.

B. Do not begin placement of the lightweight insulating concrete roof system until the insulation manufacturer's representative has examined the deck and has accepted its condition.

C. Install insulation board according to lightweight insulating concrete manufacturer's written instructions. Place insulation board in wet, lightweight insulating concrete slurry poured a minimum of 1/8 inch over the structural substrate. Ensure full contact of insulation board with slurry. Stagger joints and tightly butt insulation boards. Allow slurry coat to set prior to placing remaining thickness of lightweight insulating concrete.

1. Install insulation board in a stair-step configuration with a maximum step-down of 1 inch.
2. Fill the holes in the insulation board and place a 2 inch minimum thickness of lightweight insulating concrete over the insulation board.
3. Install the system to provide for a minimum positive roof slope of 1/4 inch per foot and tapered crickets at ½-inch per foot. Provide sumps around roof drains indicated; minimum 4' x 4' dimension. See the structural drawings for slope provided by the roof framing system.
4. Avoid rooftop traffic over the roof insulation system until one can walk over the surface without creating surface damage.
5. No ponding water will be permitted.

D. Deposit and screed lightweight insulating concrete in a continuous operation until an entire panel or section of roof area is completed. Do not vibrate or work mix except for screeding or floating. Place to depths and slopes indicated.

E. Finish top surface smooth, free of ridges and depressions, and maintain surface in condition to receive subsequent roofing system.

F. Begin curing operations immediately after placement, and air cure for not less than three days, according to manufacturer's written instructions.

G. If ambient temperature falls below 32 deg F, protect lightweight insulating concrete from freezing and maintain temperature recommended by manufacturer for 72 hours after placement.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to sample materials, perform field tests and inspections, and prepare test reports.

B. Testing of samples of lightweight insulating concrete obtained according to ASTM C 172/C 172M, except as modified by ASTM C 495, shall be performed according to the following requirements:

1. Determine as-cast unit weight during each hour of placement, according to ASTM C 138/C 138M.
2. Determine oven-dry unit weight and compressive strength according to ASTM C 495. Make a set of at least six molds for each day's placement, but not less than one set of molds for each 5000 sq. ft. of roof area.
3. Perform additional tests when test results indicate that as-cast unit weight, oven-dry unit weight, compressive strength, or other requirements have not been met.

a. Retest cast-in-place lightweight insulating concrete for oven-dry unit weight and compressive strength.

4. Inspecting agency shall state in each report whether inspected lightweight insulating concrete complies with or deviates from requirements.

3.4 DEFECTIVE WORK

A. Refinish, or remove and replace, insulating concrete surfaces that are excessively scaled or too rough to receive roofing, according to current published requirements of roofing manufacturer.

B. Remove and replace insulating concrete that fails to meet compressive strength and oven-dry unit weight requirements.

END OF SECTION 03 52 16

Division 04

Masonry

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SECTION 04 05 13
MASONRY MORTARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the mortar for unit masonry materials specified in the following Sections:

1. Concrete masonry units, Section 04 22 00.

1.2 SUBMITTALS

A. All required submittals shall be approved prior to the start of masonry construction.

B. Product Data: Proposed prepared masonry cement.

C. Proposed mortar mix design(s) including identities and proportions of ingredients as well as adherences to standards where specified.

D. Test results from mortar cube breaks reporting compressive strength of mortar.

E. Provide certification, in writing, that materials meet requirements of ASTM C1142.

1.3 QUALITY ASSURANCE

A. Codes and Specifications: Comply with the provisions of the following codes specifications, and standards, except as otherwise shown or specified.

1. ACI 530/ASCE 5/TMS 402-14 Building Code Requirements for Masonry Structures
2. ACI 530.1/ASCE 6/TMS 602-14 Specifications for Masonry Structures
3. NCMA-TEK 20B Mortars for Concrete Masonry
4. ASTM C144, Aggregate for Masonry Mortar
5. ASTM C150, Portland Cement
6. ASTM C207, Hydrated Lime for Masonry Purposes
7. ASTM C270, Mortar for Unit Masonry

B. Field Quality Control.

1. Materials may require testing and re-testing, as directed by the Architect, during the progress of the Work. Allow free access to material stockpiles and facilities. Tests shall be performed at the Owner's expense.
2. Do not change source or brands of masonry mortar material during the course of the Work. If changes become necessary, resubmit data for material being changed and for tests of materials in which the changed material is and ingredient.

1.4 TESTS FOR MORTAR

A. Test for compressive strength by the methods of sampling and testing of ASTM C109 and ASTM C780.

1. Provide a minimum of one set of cubes for testing per 5,000 sq. ft. of masonry wall construction and as directed by Architect.

B. Submit written reports for each material sampled and tested. Provide Project name and number, date of report, name of contractor, name of testing service, source of aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

C. If the compressive strength tests fail to meet the minimum requirements specified, the mortar represented by such tests will be considered deficient in strength.

1. Removed and replaced deficient mortar.

1.5 MATERIAL STORAGE, DELIVERY, AND HANDLING

A. Store mortar materials off the ground, under cover, using tarpaulins, felt paper, or polyethylene sheets in a dry location.

B. Deliver and store manufactured products in original unopened containers.

C. Store cementitious ingredients in weather-tight enclosures and protect against contamination.

D. Stock piles and handle aggregates to prevent contamination form foreign materials.

1.6 ENVIRONMENTAL REQUIREMENTS

A. To assure mortar temperatures between 40 degrees F and 120 degrees F until used heat mixing water or aggregates when air temperature is between 32 degrees F and 40 degrees F. When the air temperature is between 25 degrees F and 32 degrees F, heat both water and aggregate.

B. Produce subsequent mortar batches within plus or minus 10 degrees of first batch.

C. Do not heat water or sand above 160 degrees F.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C150, Type I, non-staining, without air entertainment and of natural color or white, to produce the required color of mortar or grout.

B. Masonry Cement: Current ASTM C91, non-staining, with 12 to 22 percent air content by volume.

C. Hydrated Lime: ASTM C207, Type S

D. Aggregates: ASTM C144, except for joint less than 1/4 inch, use aggregate graded with 100 percent passing the No. 16 sieve.

E. Water: Clean, free of deleterious materials which would impair strength or bond.

F. Ready Mixed Mortar: ASTM C270 Standard Specification for ready mixed mortar for unit masonry.

G. Integral Water Repellent Admixture: “Dry-Block Water Repellent Mortar Admixture” as manufactured by Grace Construction Products, Cambridge, MA.

2.2 MORTAR MIXES

A. Do not lower the freezing point of mortar by use of admixture or anti-freeze agents.

1. Do not use calcium chloride in mortar.

B. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification, Proportion Specifications, or ASTM C1142.

1. Type M: 2500 psi average compressive strength at 28 days for masonry in contact with the earth.
2. Type S: 1800 psi average compressive strength at 28 days for other masonry conditions.

C. Use gray (non-colored) mortar for interior and non-exposed concrete block masonry.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Refer to Section 04 22 00, Concrete Unit Masonry.

END OF SECTION 04 05 13

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SECTION 04 05 16
MASONRY GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the masonry grout for unit masonry materials specified in the following Sections:

1. Concrete masonry units, Section 04 22 00.

B. The types of masonry grout required include the following:

1. Fine grout
2. Coarse grout
3. Grout for use in hollow metal frames

1.2 SUBMITTALS

A. Product Data: Proposed portland cement

B. Proposed grout mix designs for both fine and coarse grouts including complete identities and proportions of ingredients as well as adherences to standards where specified. All grout shall be plant-mix.

C. Compression test results from an independent certified testing laboratory from grout samples made from the proposed grout mix design. Test reports may be from previous Projects within the previous 6 months.

1.3 QUALITY ASSURANCE

A. Standards: Comply with the provisions of the following in accordance with the current Florida Building Code (with applicable supplements), except as otherwise shown or specified.

1. ACI 530/ASCE 5 Building Code Requirements for Masonry Structures.
2. ACI 530.1/ASCE 6 Specifications for Masonry Structures.
3. NCMA-TEK 23-A Grouting for Concrete Masonry Walls.

A. Field Quality Control

1. Materials may require testing and re-testing, as directed by the Architect, during the progress of the Work. Allow free access to material stockpiles and facilities. Tests will be performed at the Owner's expense.
2. Do not change source or brand of masonry grout materials during the course of the Work. If changes become necessary, resubmit data for material being changed and for tests of materials in which the changed material is an ingredient.

1.4 MATERIAL STORAGE

A. Store grout materials off the ground, under cover, using tarpaulin, felt paper, or polyethylene sheets and in a dry location.

1.5 TESTS FOR GROUT

A. Provide a minimum of one set of 3 test specimens for testing per 5000 square feet of masonry wall construction and as directed by the Architect.

B. Submit written reports for each material sampled and tested. Provide Project name and number, date of report, name of contractor, name of testing service, source of aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

C. If the compressive strength tests fail to meet the minimum requirements specified, the grout represented by such tests shall be considered deficient in strength.

1. Removed and replaced deficient mortar.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C150, Type I, unless otherwise acceptable to Architect.

B. Flyash: ASTM C618-97, Type C or F may be substituted for up to 20 percent of the portland cement in the grout mix.

C. Fine Aggregates: Clean, sharp, natural sand free from loam, clay lumps, or other deleterious substances.

D. Coarse Aggregates: Clean, uncoated, pea gravel containing no clay, mud, loam, or foreign matter. Maximum aggregate size 3/4-inch.

E. Water: Clean, free of deleterious materials which may impair strength or bond.

2.2 GROUT MIXES

A. Do not use calcium chloride in grout

B. Grout, comply with ASTM C476.

1. Fine Grout: 2500 psi average compressive strength at 28 days.
2. Coarse Grout: 2500 psi average compressive strength at 28 days.
3. Use fine grout in all hollow metal frames.

C. Grout Proportions (by volume): Comply with Table 1, ASTM C476.

1. Fine Grout: 1 part portland cement, 0 to 1/10 part hydrated lime or lime putty, 2-1/4 to 3 parts fine aggregate.
2. Coarse Grout: 1 part portland cement, 0 to 1/10 part hydrated lime or lime putty, 2-/1/4 parts fine aggregate, 1 to 2 parts coarse aggregate.

D. Grout Slump: 9 to 11 inches.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Section 04 22 00, Concrete Unit Masonry.

B. Grout all steel frames installed in concrete and CMU walls. Do not install until asphaltic emulsion back coating has dried. Refer to Section 08 11 01- Steel Doors and Frames.

3.2 SAMPLING AND TESTING

A. Sampling and Testing of Grout: NCMA-TEK 107.

1. Place a piece of wood 1-5/8-inch-thick and 3 inches by 3 inches on a level surface. Four masonry units with permeable paper, such as absorptive paper toweling, taped to one face shell are placed around the wood block to form the mold. The resulting mold is approximately 3 inches square by 6 inches high. Pour grout into the mold in two layers. Rod each layer 25 times with a 1 x 2 wood puddling stick to eliminate air bubbles. Puddle the bottom layer throughout its depth. Distribute the strokes uniformly over the cross-section of the mold. For the upper layer, allow the stick to penetrate about 1/2 inch into the underlying layer. After the second lift has been puddled, level the top of the prism with a trowel and immediately cover the prism with wet burlap or similar material to keep it damp. Protect the prisms against extreme changes in temperature, and after 48 hours, remove the masonry units and carefully pack the samples for transport to the laboratory where they will be stored in a moist room until tested.
2. Cap the specimens in accordance with the applicable provisions of "Method of Capping Cylindrical Concrete Specimens," ASTM C617. The sample should be tested in a damp condition in accordance with the applicable provisions of ASTM C39 "Methods of Test Compressive Strength of Molded Concrete Cylinders."
3. Three test samples shall be made and tested for each type of grout to be used in the work.

END OF SECTION 04 05 16

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SECTION 04 05 23
MASONRY ACCESSORIES

PART 1- GENERAL

1.1 SUMMARY

A. Section includes masonry accessories for unit masonry materials specified in:

1. Concrete Masonry Units, Section 04 22 00

B. The types of masonry accessories required include the following:

1. Continuous horizontal wire reinforcing and ties.
2. Individual metal ties.
3. Anchoring devices.
4. Neoprene expansion joint filler.
5. Rubber control joints.
6. Concealed and through-wall flashings built into masonry work.
7. Reinforcing bars in masonry lintel block and hollow metal door frame heads.
8. Vertical bars for concrete masonry.
9. Caging devices and centering clips for alignment of vertical reinforcing bars.
10. Grouted anchor bolts.
11. Preformed expansion joint material.
12. Column isolation.

1.2 SUBMITTALS

A. All submittals shall be approved prior to the start of masonry construction.

B. Product Data, with particular items to be provided, clearly marked, for:

1. Masonry joint reinforcement
2. Masonry in-wall flashing
3. Neoprene expansion joint filler
4. Rubber control joint

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Provide masonry reinforcing as manufactured by one of the following;

1. Heckmann Building Products, Inc., Chicago, Illinois; http://www.heckmannbuildingprods.com
2. Masonry Reinforcing Corp. of America, Charlotte, North Carolina; http://www.wirebond.com
3. Hohmann & Barnard, Inc., Hauppauge, New York; http://www.h-b.com

2.2 MATERIALS

A. Continuous Wire Reinforcing and Ties for Masonry

1. Provide welded wire units prefabricated in straight lengths of not less than 10 foot, with matching pre-fabricated corner ("L") and intersection ("T") units.
2. Fabricate from cold-drawn steel wire complying with ASTM A1064, with deformed or embossed continuous side rods and plain cross-rods, with unit width of 1-1/2 to 2 inches less than thickness of wall partition.
3. Wire shall be galvanized in accordance with the following:

    a. Joint reinforcement, interior walls: Mill galvanized wire ASTM A641 Class 1 (0.40 oz. per sq. ft.)
    b. Wire ties or anchors in exterior walls completely embedded in mortar or grouts: Mill galvanized ASTM A641 Class 3 (0.80 oz. per sq. ft.)
    c. Wire ties or anchors in exterior walls not completely embedded in mortar or grout (includes cavity walls): Hot dip galvanized ASTM A153 Class B2 (1.50 oz. per sq. ft.)
    d. Joint reinforcement in exterior walls or interior walls exposed to moist environments such as showers, food service areas, and toilet rooms: Hot dip galvanized ASTM A153-B2 (1.50 oz. per sq. ft.)
    e. Sheet metal ties or anchors exposed to weather metal: Hot dip galvanized ASTM A153 B2 (0.60 oz. per sq. ft.)
    f. Sheet metal ties or anchors completely embedded in mortar or grout: ASTM 653 (0.60 oz. per sq. ft.)

4. For single wythe interior CMU walls, provide truss ladder type joint reinforcing fabricated with two 9 gage steel side rods and 9 gage cross rods. Joint reinforcing shall be placed in every other CMU joint or not more than 16 inches o.c.
5. For single wythe foundation walls, provide truss ladder type joint reinforcing fabricated with two 9 gage steel rods and 9 gage cross rods. Joint reinforcing shall be placed in every CMU joint or no more than 8 inches o.c.

B. Adjustable Masonry Wall Ties: Shall be fabricated from 3/16 inch cold-drawn galvanized steel wire, complying with ASTM A1064, of the length required for proper embedment in wythes of masonry shown, or crimped if used in cavity wall construction. Provide either "rectangular" or "Z" ties for proper anchorage in mortar joint.

C. Anchoring Devices for Masonry

1. Rigid Anchors: Where masonry is to be rigidly anchored to structural steel beams, such as lintel beams, provide galvanized steel straps, bars, or rods welded to the steel beam and extending into the mortar joint. Straps shall be not less than 14 gage in thickness. Bars and rods shall be not less than 1/4 inch in diameter.
2. Flexible Anchors: Where masonry is to be laterally supported from structural steel, while permitting only vertical movement or both vertical and horizontal movement, provide flexible anchors consisting of 2 different components as follows:

    a. Web Ties or Beam Ties: Shall be 3/16-inch galvanized steel wire, ASTM A1064, 12 inches long with width being approximately 2 inches less than nominal wall thickness. Provide ties with blunt end when used with strap anchors and provide

ties with tapered end when used with rod anchors. This type tie shall permit only vertical movement and shall be installed parallel to masonry walls that abut steel columns.

b. Triangular Ties: Shall be 3/16-inch galvanized steel wire, ASTM A1064, lengths as required to extend to within 5/8 inch of opposite face of masonry. Closed end shall be 1 inch wide, and split-end opening shall be 1/2 inch. This type tie shall permit both vertical and horizontal movement and shall be installed where masonry by-passes steel columns and where masonry is parallel and adjacent to steel beams and joists.

c. Flexible anchors: Where masonry is to be laterally supported from cast-in-place or precast concrete, provide 22 gage galvanized dovetail slots with 3/16-inch diameter galvanized triangular ties.

3. Dowels on Lintels: Where masonry is supported on the top of lintels and plates provide #4 reinforcing bar by 6 inch rods or 1/2 inch diameter by 6 inch headed studs at 32 inch spacing, unless otherwise noted, welded to top of steel and extending into cores or cavity of masonry above. Grout cores or cavity at rods.

D. Neoprene Expansion Joint Filler (for face brick)

1. Provide expansion joints in exterior brick masonry conforming to ASTM D-1056 where indicated on the Drawings. The following products are acceptable:

a. "Neo-Seal IV 2218-3" as manufactured by Williams Products, Inc., Troy, Michigan; or Architect approved equal; http://www.sweets.com/index/mfg.htm?site=undefined&id=624

E. Rubber Control Joints

1. Provide rubber control joints designed for standard sash block in CMU walls where control joints (CJ) are indicated on the Drawings or as specified in Section 04200. The following products are acceptable. Rubber control joints shall conform to ASTM D2000.

a. Basis of Design: "Everlastic Slot Seal Std. 2015-3" as manufactured by Williams Products, Inc., Troy, Michigan. http://www.sweets.com/index/mfg.htm?site=undefined&id=624

b. Other equal products as manufactured by Dur-o-wal or Heckman are acceptable.

F. Through-Wall Flashing:

1. Provide flashings, shown to be built into masonry, extended, exposed beyond the exterior surface of the wall.

a. Firestone FLASHGUARD, EPDM Rubber Membrane, 40mil thickness
b. Stainless steal: 0.0156 thick, ASTM A 240, Type 304

2. All masonry wall flashings are to be set in a bed of mortar and covered with a bed of mortar.
3. All seams shall be welded and watertight.

a. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer

G. Reinforcing Bars

1. Size, length, and spacing shall be as indicated on the Drawings.
2. Where No.3 and larger are indicated, they shall be deformed steel, conforming to ASTM A615, Grade 60.

H. Intersecting Masonry Wall Joint Reinforcing: Horizontal bed joint reinforcement for conditions where interior non-load-bearing masonry walls intersect exterior or interior load-bearing walls at 90 degrees shall be wire mesh wall ties made of 1/2-inch mesh by 16 gage hot dip mill-galvanized wire, 1 inch less in width than width of wall.

I. Column Isolation: Around all columns in masonry walls, provide 3/8 inch “Ceramar Flexible Foam” expansion joint filler as manufactured by W.R. Meadows, Inc.: http://wrmeadows.com, or Architect approved equal.

J. Caging Devices and Centering Clips

1. In hollow concrete masonry cores or brick cavities to be reinforced with vertical reinforcing steel bars and filled with grout, provide 9 gage galvanized steel caging devices. The following products are acceptable:

   a. Rebar Positioner AA239, AA Wire Products Company, Chicago, Illinois; or Architect approved equal.
   b. Rebar Positioner 3400, Masonry Reinforcing of America, Charlotte, North Carolina; or Architect approved equal.
   c. Spider Type Rebar Positioner, National Wire Products Industries, Baltimore, Maryland; or Architect approved equal.

K. Grouted Anchor Bolts

1. In hollow concrete masonry units: HILTI HY 70 Renovation Anchors, Hilti, Inc., Tulsa, Oklahoma; http://www.us.hilti.com; or Architect approved equal.
2. In solid or grouted masonry units: HILTI HY 100 System, Hilti, Inc., Tulsa, Oklahoma; http://www.us.hilti.com; or Architect approved equal.

L. Preformed Expansion Joint Material: Provide closed cell polyethylene expansion joints equal to "Expansion-Joint Filler" by Sonneborn Building Products; or Architect approved equal. http://www.chemrex.com/sonneborn/index.htm

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 04 22 00, Concrete Unit Masonry, for installation of masonry accessories specified under this Section.

END OF SECTION 04 05 23

SECTION 04 22 00
CONCRETE UNIT MASONRY

PART 1 – GENERAL

1.1 SUMMARY

A. Provide labor, materials, and equipment necessary for complete installation of unit masonry as shown on the Drawings and specified herein.

B. Work installed under this Section, but materials or products furnished under the following Divisions or Sections:

1. Masonry mortar furnished under the Work of Section 04 05 13.
2. Masonry grout furnished under the Work of Section 04 05 16.
3. Masonry accessories furnished under the Work of Section 04 05 23.
4. Anchor bolts, steel plates, and steel lintels; refer to Division 5

a. Installation of lintels in masonry walls shall be included under the Work of this Section.

5. Wood bucks and nailing blocks in masonry construction; refer to Division 06.

C. Work installed under this Section, but materials or products furnished under the following Divisions or Sections:

1. Architectural Concrete Unit Masonry furnished under the work of Section 04 22 23.

D. Cooperate with other trades requiring items of equipment or services to be installed within or in conjunction with Unit Masonry Work.

E. Other Materials provided and installed by this Section:

1. Integral color
2. Integral water repellent additive
3. Masonry cleaners

1.2 SUBMITTALS

A. Test report from independent laboratory showing result of efflorescent test conducted per ASTM C67 for each provided face brick type.

B. Upon regular presentation within past 6 months of representative units by approved manufacturer, a test report from an independent laboratory showing resultant weight, compressive strength (based on net area), and water absorption properties, as well as adherences to standards where so specified, for:

Name of Manufacturer

Date of Manufacture of Test Specimen
Dimension Measurements (in.)
Calculated Gross Area (sq.in.)
Calculated Net Area (sq.in.)
Total Load (lbs.)
Net Unit Load (psi)
Sample Weight (lbs.)
Dry Weight (lbs.)
Wet Weight (lbs.)
Immersed Weight (lbs.)
Density (pcf)
Moisture Content (%)
Absorption (%)

C. Letter from approved manufacturer certifying that provided units will meet or exceed qualities of tested representative units for:

1. Each proposed type of concrete masonry unit.

D. Mock-up panels as erected on site grounds are only samples required.

E. Approved manufacturer's published complete product data, with particular items to be provided clearly marked thereon, for:

1. Proposed masonry cavity wall insulation.
2. Integral color.
3. Integral water repellant additive.

F. A test report from an independent testing laboratory showing compressive strength of concrete masonry prisms constructed from the concrete masonry units and mortar to be used in the masonry work for:

1. Each proposed type and size of concrete masonry unit as required on the Reinforced Masonry Plans in the Drawings.

G. Submit minutes from preinstallation conference.

H. Fire-rated CMU certification.

I. Installer’s examination report.

J. Submit written masonry inspection reports as specified in 1.3.C herein.

1.3 QUALITY ASSURANCE

A. Standards: Comply with the provisions of the following in accordance with the Florida Building Code 7th Edition (2020), except as otherwise shown or specified.

1. ACI 530/ASCE 5/TMS 402-14 Building Code Requirements for Masonry Structures
2. ACI 530.1/ASCE 6/TMS 602-14 Specifications for Masonry Structures
3. NCMA-TEK 70A Concrete Masonry Prism Strength.
4. NCMA-TEK 132

5. NCMA-TEK 23A Grouting for Concrete Masonry Walls.
6. NCMA-TEK 65 Field Inspection of Engineered Concrete Masonry.
7. ASTM C140 Standard Methods of Sampling and Testing Concrete Masonry Units.
8. Comply with ALL NCMA-TEK Standards.

B. Changes in the source or brand of masonry materials during construction will require resubmission and re-testing at the Contractor's expense.

C. Job Mock-Up (if required by Archited)

1. Prior to installation of masonry work, erect sample wall panel mock-up using materials, bond, and joint tooling shown or specified for final work. Provide special features as directed for caulking and contiguous work. Build mock-up at the site, where directed, of full thickness and approximately 4'x4', unless otherwise shown, indicated the proposed range of color, texture, and workmanship to be expected in the completed work. Erect panels with finish face of panels facing south. Obtain Architect's acceptance of visual qualities of the mock-up before start of masonry work. Retain mock-up during construction as a standard for judging completed masonry work. Do not alter, move, or destroy mock-up until work is completed. Provide mock-up panel for the following:

   a. Typical exterior CMU wall indicating all of the different types of CMU and finishes as specified herein.
   b. Typical interior partition of concrete masonry units.

D. Fire Performance Characteristic: Where indicated, provide materials and construction identical to those of assemblies whose fire resistance has been determined per ASTM E119 by a testing and inspection organization, by equivalent concrete masonry thickness, or by other means acceptable to authorities having jurisdiction.

1.4 TESTS OF CONCRETE MASONRY PRISMS

A. For grout filled and reinforced or un-reinforced concrete masonry or brick masonry wall construction tests for the compressive strength of prisms as described in ASTM C 1314.

1. Provide a minimum of one set of 3 masonry prisms for testing per each 5000 square feet of masonry wall construction as required on the Structural Masonry Plan in the Drawings.

B. Submit written reports for each prism tested Provide the project identification name and number, date of report, name of Contractor, name of Testing service, name of material suppliers, specific location where masonry represented by the prism is used, test results, and values specified in the referenced specification. Indicate whether or not tested prism is acceptable for intended use.

C. If the compressive strength tests fail to meet the minimum requirements specified, the concrete masonry represented by such tests shall be considered deficient in strength.

D. Deficient masonry construction shall be removed and replaced by the Contractor without additional cost to the Owner. In lieu or removal and replacement, additional cores may be grouted as required and directed by the Architect without additional cost to the Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry materials to project in undamaged condition.

B. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.

C. Store cementitious materials off the ground, under cover, and in dry location.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

A. Protect partially complete masonry against weather, when Work is not in progress, by covering top of walls with strong, waterproof, non-staining membrane. Extend membrane at least 2 foot down both sides of walls and anchor securely in place.

B. Protect partially complete masonry walls against wind damage by bracing as required until support of walls is integral with the building structure.

C. Protect masonry against freezing when the temperature of the surrounding air is 40 degrees F and falling. Heat materials and provide temporary protection of complete portions of masonry work. Comply with the requirements of the governing code and with the "Construction and Protection Recommendations for Cold Weather Masonry Construction" of the Technical Notes of Brick and Tile Construction by the Brick Institute of America (BIA).

D. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from mortar droppings.

E. Cold-Weather Construction: Comply with referenced unit masonry standard for cold-weather construction and the following:

1. Do not lay masonry units that are wet or frozen.
2. Remove masonry damaged by freezing conditions.

F. Hot-Weather Construction: Comply with referenced unit masonry standard.

G. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Comply with referenced unit masonry standard and other requirements specified in this Section applicable to each material indicated.

2.2 MASONRY UNITS

A. Obtain masonry units from one manufacturer for uniform texture and color for each kind required, for each continuous area and visually related areas.

B. Concrete Masonry Units (CMU):

1. Manufacturer: Shall be member of the National Concrete Masonry Association
2. Size: Manufacturer's standard units with face dimensions of 15-5/8 by 7-5/8 inches (actual), 15-5/8 inches by 3-5/8 inches (actual), 7-5/8 inches by 7-5/8 inches.
3. Special Shapes: Provide, where shown and where required, lintels, inside and outside corners, jambs, sash, control joints, headers, bond beams, bullnoses, and other special conditions.

    a. Provide bullnose corners at all exposed external corners (except at heads), and sills.
    b. Not required at exterior columns, planters, and seat walls.

4. Hollow Load-Bearing (HL) CMU: Provide units complying with ASTM C90, 2N Class Designation for the aggregates, with a minimum compressive strength of (2420 psi) (1900 psi) on the net section.
5. Solid Loadbearing CMU (Solid CMU): Provide units complying with ASTM C90, 2N Class Designation for the aggregates, with a minimum compressive strength of (2420 psi) (1900 psi) on the gross section.
6. Lightweight Units: ASTM C331 aggregate, except that aggregate material shall be limited to blast furnace slag, clay, shale, or slate. Dry net weight shall be not more than 105 lbs. per cu. ft. Strength shall be indicated above.
7. Medium Weight Units: ASTM C33 concrete aggregates for a net weight between 105 pounds and 125 pounds per cu. ft. Strength shall be as indicated above.
8. Normal Weight Units: ASTM C33 concrete aggregates for a dry net weight of not less than 125 pounds per cu. ft. Strength shall be as indicated above.
9. Curing: Cure units in a moisture-controlled atmosphere or in an autoclave at normal pressure and temperature to comply with ASTM C90, Type I. (Linear drying shrinkage shall be 3 percent or less).
10. Curing: Cure units in a non-moisture-controlled atmosphere to comply with ASTM C90, Type II.
11. Exposed Face:

    c. Manufacturer's standard color and texture. Smooth (Sand) face. No open textured block will be accepted.
    b. Split-face CMU where indicated. Provide heavy weight classification of over 125 lbs. per cu. ft. of concrete.
    c. Open textured face CMU made with gap-graded aggregates.

    d. Smooth face scored CMU where indicated.

12. Where CMU walls are indicated as fire-rated, provide materials and construction identical to those of assemblies whose fire resistance has been determined per ASTM E119 by a testing and inspection organization, by equivalent concrete masonry thickness, or by other means as acceptable to authorities having jurisdiction.
13. Fire Rated CMU shall meet requirements of the UL 618 and may be lightweight block manufactured with 100% rotary kiln produced expanded shale, clay, or slate. Blending of screenings or any other deleterious substance which impairs the fire rating is prohibited. The producer of the CMU shall furnish a one page certification showing conformance with all requirements of UL 618.
14. Provide masonry lintels at all openings greater than 1'-0" in width that occur in CMU walls.

2.3 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of trisodium phosphate (1/2-cup dry measure) and laundry detergent (1/2-cup dry measure) dissolved in one gallon of water.

B. Job-Mixed Muriatic Solution: Solution of 1 part muriatic acid and 10 parts clean water, mixed in a nonmetallic container with acid added to water.

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned:

1. For masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface-acting acids, chelating, and wetting agents.
2. For dark colored masonry not subject to metallic oxidation stains, use formulation consisting of a liquid blend of surface-acting acids and special inhibitors.
3. For masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic and inorganic acids and special inhibitors.
4. Available Products: Subject to compliance with requirements, a product that may be used to clean unit masonry surfaces includes, but is not limited to, the following:
5. Products: Subject to compliance with requirements, provide the following:

    d. "Sure Klean No. 600 Detergent," ProSoCo, Inc.
    e. "Sure Klean No. 101 Lime Solvent," ProSoCo., Inc.
    f. "Sure Klean Vana Trol," ProSoCo, Inc.

2.4 INTEGRAL WATER REPELLANT ADDITIVE

A. Acceptable Manufacturers: "Dry-Block" by W.R. Grace and Company; or Architect approved equal.

B. Install the integral waterproofing additive in all smooth face CMU, split-face CMU and ground face CMU installed in exterior walls.

C. Integral water repellent additive shall comply with ASTM E514, extended to 72 hours, ASTM C1357, ASTM C1314, and ASTM C1148.

D. Description: Integral liquid polymeric admixture for CMU added during block production.

E. Water Permeance of Masonry: Capable of achieving a Class E Rating when evaluated using ASTM E 514 with the test extended to 72 hours, using the rating criteria specified in ASTM E 514-74.

F. Flexural Bond Strength of Masonry: An increase of minimum 10% in masonry flexural bond strength shall occur as a result of adding integral water-repellent CMU and mortar admixtures when compared to a control (containing no admixtures) CMU and mortar when tested according to ASTM C 1357.

G. Compressive Strength of Masonry Prisms: Maximum 5% decrease in compressive strength of prisms shall occur as a result of adding integral water-repellent CMU and mortar admixtures when compared to a control (containing no admixtures) CMU and mortar when tested according to ASTM C 1314.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other specific conditions, and other conditions affecting performance of unit masonry.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of unit masonry.

B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with referenced unit masonry standard and other requirements indicated applicable to each type of installation included in Project.

B. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.

C. Build chases and recesses as shown or required to accommodate items specified in this and other Sections of the Specifications. Provide not less than 8 inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.

D. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.

E. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units

without cutting where possible.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of new masonry with existing masonry.

G. Frozen Materials and Work: Do not use frozen materials mixed or coated with ice or frost. For masonry which is specified to be wetted, comply with the BIA recommendations. Do not build on frozen work. Remove and replace masonry work damaged by frost or freezing.

3.3 CONSTRUCTION TOLERANCES

A. Comply with construction tolerances of referenced unit masonry standard.

B. Variation from Plumb: For vertical lines and surfaces of columns, walls and arises do not exceed1/4" in 10", or 3/8" in a story height not to exceed 20', nor 1/2" in 40' or more. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4" in any story or 20' maximum, nor 1/2" in 40' or more. For vertical alignment of head joints do not exceed plus or minus 1/4" in 10', 1/2" maximum.

C. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4" in any bay or 20' maximum, nor 1/2" in 40' or more. For top surface of bearing walls do not exceed 1/8" between adjacent floor elements in 10' or 1/16" within width of a single unit.

D. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls and partitions, do not exceed 1/2" in any bay or 20' maximum, nor 3/4" in 40' or more.

E. Variation in Cross-Sectional Dimensions: For columns and thicknesses of walls, from dimensions shown, do not exceed minus 1/4" nor plus 1/2".

F. Variation in Mortar Joint Thickness: Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8"

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.

B. Lay up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

1. For the first and second block courses above and below apertures, run reinforcing continuous or extend two feet back from aperture edge. Refer to notes on Structural drawings.

C. Lay-up walls plumb and true and with courses level, accurately spaced and coordinated with other work. Do not wedge partitions tight against structural ceiling or beams, but provide a caulk or insulation filled joint between top of masonry and the structural roof deck, structural steel framing or structural floor deck. Stop masonry a minimum of 1/2 inch from vertical, horizontal and

sloped steel surfaces.

D. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly (if required), and remove loose masonry units and mortar prior to laying fresh masonry.

E. Built-In Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
3. Fill cores in hollow concrete masonry units with grout 3 courses (24 inches) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
4. Install adjustable hollow metal frame anchors, locating anchors on jambs in horizontal bed courses near the top and bottom of each frame and at intermediate points not over 24 inches apart.
5. Fill jambs and heads of all hollow metal door and window frames installed in CMU or concrete walls solid with grout.
6. Rake joints around exterior side of exterior hollow metal door frames for sealant under Division 7.
7. Where hollow metal frames do not wrap around masonry jambs and heads, rub exposed corners of block to remove sharp, irregular edges.

F. Intersecting Masonry Walls: Where interior nonload-bearing masonry partition or wall intersects an exterior or interior load-bearing masonry wall at 90 degrees, stop horizontal joint reinforcing in interior partition 4 inches short of intersection. Horizontal joint reinforcing in exterior or interior load-bearing wall shall run continuous. In the same courses as horizontal reinforcing, install wire mesh extending 8 inches minimum into interior partition and projecting into the exterior wall to within 2 inches of exterior face of wall. Install wire mesh reinforcing in horizontal joints 16 inches o.c. vertically.

G. Intersecting Masonry Walls: Where interior CMU walls intersect other CMU walls located in all Cells and areas accessible to inmates, or jail population, all intersecting walls shall be of “toothed” construction. Interlock every other course by “toothing” every other course.

H. Grout masonry walls where indicated on drawings.

3.5 MORTAR BEDDING AND JOINTING

A. Mix mortar ingredients for a minimum of 5 minutes in a mechanical batch mixer. Use water clear and free of deleterious materials which would impair the work. Each mortar batch is allowed only one retempering. Do not use mortar which has begun to set after the first re-tempering or if more than 2-1/2 hours has elapsed since initial mixing.

B. Lay solid masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Butter ends of brick in hand and in the wall at closures. Do not slush head joints.

C. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells; also bed webs in mortar in starting course on footings and foundation walls and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or to be filled

with concrete or grout.

D. Joints: Maintain joint widths shown, except for minor variations required, to maintain joint alignment. Lay walls with 3/8-inch joints. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials. For exposed masonry, provide joints as follows:

1. All Exposed Joints: Concave tooled.
2. All Concealed Joints: Struck flush.

E. Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jams to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

3.6 HORIZONTAL JOINT REINFORCEMENT

A. Provide continuous horizontal joint reinforcing as shown and specified. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch on exterior side of walls and 1/2 inch at other locations. Lap reinforcement a minimum of 6 inches at ends of units. Do not bridge control and expansion joints with reinforcing.

B. Space continuous horizontal reinforcing as specified in Section 04 05 24.

C. Reinforce masonry openings greater than 1 foot wide, with horizontal joint reinforcing placed in 2 horizontal joints approximately 8 inches apart, both immediately above the lintel and immediately below the sill. Extend reinforcing a minimum of 2 foot beyond jambs of the opening except at control joints.

D. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

E. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 ANCHORING SINGLE-WYTHE MASONRY VENEER

A. Anchor single-wythe masonry veneer to metal studs with masonry veneer anchors to comply with the following requirements:

1. Fasten each anchor section through sheathing to metal studs with 2 metal fasteners of type indicated.
2. Embed tie section in masonry joints. Provide not less than 2-inch air space between back of masonry veneer wythe and face of sheathing.
3. Locate anchor section relative to course in which tie section is embedded to allow maximum vertical differential movement of tie up and down.
4. Space anchors as indicated but not more than 16 inches o.c. vertically and 16 inches o.c. horizontally with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 1'-0" of openings and at intervals around perimeter not exceeding 8 inches.

B. Install vents at the top of each continuous air space in masonry veneer walls.

3.9 MOVEMENT (CONTROL AND EXPANSION) JOINTS

A. Install control and expansion joints in unit masonry where indicated, or if not indicated, space at a maximum of 1 1/2 times the wall height not to exceed 25’ o.c. Build in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Fit bond breaker strips into hollow contour in ends of block units on one side of control joint. Fill the resultant core with grout and rake joints in exposed faces.
2. Install preformed control joint gaskets designed to fit standard sash block.
3. Install special shapes designed for control joints. Install bond breaker strips at joint. Keep head joints free and clear of mortar or rake joint

C. Build in horizontal pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting nonmetallic 50 percent compressible joint filler of width required to permit installation of sealant and backer rod specified in Division 7 Section "Joint Sealers."

1. Locate horizontal pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

D. Control Joint Locations: If control joints are not shown on the Drawings, provide as follows:

1. Not to exceed 25 feet between joints in CMU walls, unless otherwise noted.
2. At change from wall setting on foundation to wall setting on floor slab.
3. At change from exterior wall to interior wall.
4. At walls setting on floors, that cross floor construction and control joints.
5. At columns within masonry walls.
6. At changes in wall thickness.

E. Column Isolation from Masonry: Continuously wrap steel columns or structural supports within masonry walls with 3/8-inch expansion joint filler sheets (column isolation). Secure with light gage wire. Refer to Section 04 05 24 for column isolation specifications.

3.10 LINTELS

A. Install steel lintels where indicated and/or as required for masonry openings.

B. Provide masonry lintels where shown and wherever openings of more than 1'-0" for brick size units and 2'-0" for block size units are shown without structural steel or other supporting lintels. Provide formed-in-place masonry lintels. Temporarily support formed-in-place lintels.

1. For hollow concrete masonry unit walls, use specially formed bond beam units with reinforcement bars placed as indicated and filled with coarse grout.

C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

D. For all openings in non-load bearing CMU or brick, with lintels not shown on Structural Drawings, provide the following lintels:

1. CMU Lintel: Use bond beam lintel block. Fill with concrete or grout. All lintel block shall be 8” nominal height by the wall thickness. Extend lintel 24” into wall on each side of opening. Concrete or grout shall have a minimum of f’c = 4000 psi. Provide 2 - #5 rebar top and bottom. Lintel shall be shored in the center for 28 days. Maximum lintel clear span = 10’-0”.

3.11 INSTALLATION OF REINFORCED UNIT MASONRY

A. Install reinforced unit masonry to comply with requirements of referenced unit masonry standard.

B. Temporary Formwork: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

C. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

D. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

3.12 GROUTED FOUNDATION WALLS

A. Where concrete masonry foundations are required by the Drawings, reinforcing and grouting shall be completed within 72 hours after the completion of the wall and prior to backfilling on either side of the foundation wall.

3.13 VERTICAL REINFORCED CONCRETE MASONRY

A. Where grout filled or steel reinforced concrete block masonry foundations or masonry walls are called for on the Drawings, they shall be reinforced and grouted in accordance with the Drawings and details. All cells to be grouted shall be clean and free of mortar protrusions and droppings in the cells.

B. The low-lift grouting procedure shall be used as described in the Drawings and in NCMA-TEK 23A Grouting for Masonry Walls. Maximum height of grouting shall be 5 feet.

C. Grout to completely fill each cavity with homogenous grout, extending from the lowest course to the top of the reinforced portion of the foundation or wall. Concrete or mortar shall not be used as grout for CMU.

1. Aggregate used in the grout shall be small enough not to interfere with placement and plasticity.

D. After the grout is placed, it shall be consolidated with a small vibrator. The top of the grout filling shall be stopped 1-1/2 inches below the top of the concrete block, except for the top course in the wall where the grout shall be struck flush with the top. If highly absorptive masonry units are used, the grout shall be re-vibrated after it has begun to stiffen.

E. Caging devices and centering clips shall be spaced vertically such that every section of vertical reinforcing steel bar is restrained by 2 clips or devices, one near its top and one near its bottom.

3.14 ANCHORING MASONRY WORK

A. Provide anchoring devices of the type shown and as specified.

B. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:

1. Provide an open space not less than 1/2-inch width between masonry and structural member, unless other types of anchoring devices are shown. Keep open space free of mortar or other rigid materials.
2. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections, unless other types of anchoring devices are shown.
3. Space anchors as shown, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally.
4. The ends of wall ties shall be embedded in mortar joints. Wall tie ends shall engage outer face shells of hollow units by at least 1/2 inch. Wire wall ties shall be embedded at least 1-1/2 inch into the mortar bed of solid masonry units or solid grouted hollow units.
5. Unless otherwise required, wythes not bonded by headers shall be bonded with wall ties as follows:

    a. Size - Minimum number of ties required
    b. #9 gage - One wall tie wire per 2.67 sq.ft.
    c. 3/16-inch diameter - One wall tie wire per 4.50 sq.ft.

6. Unless accepted by the Architect/Engineer, reinforcement shall not be bent after being embedded in grout or mortar.
7. Unless otherwise required adjustable ties shall meet the following requirements:

    a. Use one tie for each 1.77 sq.ft. of wall area.
    b. Neither horizontal nor vertical spacing shall exceed 16 inches.
    c. Maximum misalignment of bed joints from one wythe to the other shall be 1-1/4 inch.

d. Maximum clearance between connecting parts of the ties shall be 1/16 inch.

3.15 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.

C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean concrete masonry by means of cleaning method indicated in NCMA TEK 8-2A applicable to type of stain present on exposed surfaces.
6. Clean all exposed concrete masonry of efflorescence in strict accordance with NCMA TEK 8-3A.

D. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

END OF SECTION 04 22 00

SECTION 04 22 23
DECORATIVE CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Decorative concrete masonry units.
2. Mortar and grout.

B. Products Installed but not Furnished under This Section:

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

C. Samples for Initial Selection:

1. Decorative CMUs, in the form of small-scale units.
2. Colored mortar.

D. Samples for Verification: For each type and color of the following:

1. Exposed CMUs.
2. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.

E. Qualification Data: For testing agency.

F. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties.
b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellant used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.

G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

H. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

1.5 QUALITY ASSURANCE

A. Refer to section 04 20 00 “Unit Masonry.”

1.6 DELIVERY, STORAGE, AND HANDLING

A. Refer to section 04 20 00 “Unit Masonry.”

1.7 FIELD CONDITIONS

A. Refer to section 04 20 00 “Unit Masonry.”

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

2.3 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514/E 514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) ACM Chemistries.
2) BASF Corporation; Construction Systems.
3) Grace Construction Products; W.R. Grace & Co. -- Conn.

C. Decorative CMUs: ASTM C 90.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Oldcastle, Trenwyth, Trendstone Plus or comparable product by one of the following:

a. A-1 Block Coporation.
b. Cemex.
c. Kingston Block & Masonry Supply.

2. Pattern and Texture: Filled and ground-face finish.
3. Color: Match Architect's samples.

2.4 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Davis Colors.
    b. Lanxess Corporation.
    c. Solomon Colors, Inc.

E. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C 404.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. BASF Corporation; Construction Systems.
b. Euclid Chemical Company (The); an RPM company.
c. Grace Construction Products; W.R. Grace & Co. -- Conn.

H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ACM Chemistries.
b. BASF Corporation - Admixture Systems.
c. Grace Construction Products; W.R. Grace & Co. -- Conn.

I. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

1. Refer to Section 04 20 00 “Unit Masonry.”

2.7 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for job-mixed mortar; and ASTM C 1142 for ready-mixed mortar, of types indicated below:

1. For masonry below grade, in contact with earth, and where indicated, use type indicated below:

a. Type: S or M.

2. For reinforced masonry and where indicated, use type indicated below:

a. Type: S.

3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions, and for other applications where another type is not indicated, use type indicated below:

a. Type: S.

C. Grout for Unit Masonry: Comply with ASTM C 476. Use grout of consistency indicated or, if not otherwise indicated, of consistency (fine or coarse) at time of placement that will completely fill spaces intended to receive grout.

1. Use fine grout in grout spaces less than 2 inches in horizontal dimension, unless otherwise indicated.
2. Use coarse grout in grout spaces 2 inches or more in least horizontal dimension, unless otherwise indicated.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Mix to match Architect's sample.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:

   a. Decorative CMUs.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

2.8 INTEGRAL WATER REPELLANT ADDITIVE

A. Acceptable Manufacturers: “Dry-Block” by W.R. Grace and Company; or Architect approved equal.

B. Install the integral waterproofing additive in all smooth face CMU, split-face CMU and ground face CMU installed in exterior walls.

C. Integral water repellent additive shall comply with ASTM E514, extended to 72 hours, ASTM C1357, ASTM C1314, and ASTM C1148.

D. Description: Integral liquid polymeric admixture for CMU added during block production.

E. Water Permeance of Masonry: Capable of achieving a Class E Rating when evaluated using ASTM E 514 with the test extended to 72 hours, using the rating criteria specified in ASTM E 514-74.

F. Flexural Bond Strength of Masonry: An increase of minimum 10% in masonry flexural bond strength shall occur as a result of adding integral water-repellent CMU and mortar admixtures when compared to a control (containing no admixtures) CMU and mortar when tested according to ASTM C 1357.

G. Compressive Strength of Masonry Prisms: Maximum 5% decrease in compressive strength of prisms shall occur as a result of adding integral water-repellent CMU and mortar admixtures when compared to a contr ol (containing no admixtures) CMU and mortar when tested according to ASTM C 1314.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Refer to section 04 20 00 “Unit Masonry.”

3.2 INSTALLATION, GENERAL

A. Refer to section 04 20 00 “Unit Masonry.”

3.3 TOLERANCES

A. Refer to section 04 20 00 “Unit Masonry.”

3.4 LAYING MASONRY WALLS

A. Refer to section 04 20 00 “Unit Masonry.”

3.5 MORTAR BEDDING AND JOINTING

A. Refer to section 04 20 00 “Unit Masonry.”

3.6 MASONRY-JOINT REINFORCEMENT

A. Refer to section 04 20 00 “Unit Masonry.”

3.7 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.

3.8 LINTELS

A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.9 REINFORCED UNIT MASONRY INSTALLATION

A. Refer to section 04 20 00 “Unit Masonry.”

3.10 FIELD QUALITY CONTROL

A. Refer to section 04 20 00 “Unit Masonry.”

3.11 REPAIRING, POINTING, AND CLEANING

A. Refer to section 04 20 00 “Unit Masonry.”

END OF SECTION 04 22 23

Division 05

Metals

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SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. The Work required under this Section consists of structural steel, steel erection, shop painting, field touch-up painting, and related items necessary to complete the Work.

B. Miscellaneous angles, channels, anchor bolts, bent plates, sleeves, sag rods, leveling plates, bearing plates for structural steel and steel joists, and other incidental items of structural steel required to be built into concrete or masonry shall be provided as indicated or specified and be furnished to respective trades at proper time; including instructions and templates for their installation.

C. Provide, where specifically called for; steel shelf angles, perimeter angle closure, and accessories.

D. For openings in metal deck 12 by 12 inches and larger, provide steel reinforcing members. Reinforcing shall be not less than 4 by 4 inches by 1/4-inch angles, unless noted otherwise on Drawings. Openings in deck shall be cut under Section 05 31 00.

1.2 SUBMITTALS

A. Product data or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. High-strength bolts (each type), including nuts and washers.
2. Structural steel primer paint.
3. Shrinkage-resistant grout.

B. Shop drawings shall be prepared under supervision of a licensed Structural Engineer, in the State in which the Project is located. The shop drawings shall include complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams.

1. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols and show size, length, and type of each weld.
2. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.
3. Complete shop drawings by approved fabricator including plan layouts of columns and anchor bolt locations, erection diagrams, and shop detail drawings. Symbols and indications used for structural components on design drawings must appear identically on submitted shop drawings. Types of electrodes proposed for welding processes must also appear thereon.

    a. The fabricator must review and check shop drawings prior to submission to the Architect.

C. Test reports conducted on shop- and field-bolted and welded connections. Include data on

type(s) of tests conducted and test results.

D. Shop drawing packages shall be by building submitted in sequence corresponding to Construction Manager's building construction schedule.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following:

1. AISC "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" and including the "Commentary of the AISC Specification," and the current supplements.
3. AISC "Specifications for Structural Joints using ASTM A325 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
4. AWS "Structural Welding Code," AWS D1.1 and its latest revision.
5. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piping, and Bars for Structural Use."

B. Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with AWS "Qualification" requirements.

1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests. Documentation of current certification is required.
2. If re-certification of welders is required, retesting will be Contractor's responsibility.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. If bolts and nuts become dry or rusty, clean and re-lubricate before use.

1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.5 INSPECTION

A. The materials and workmanship to be furnished under this Specification shall be subject to inspection in the mill, shop, and field by the Architect/Engineer. Inspection will be conducted without expense to the Contractor; however, inspection in the mill or shop shall not relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with Contract Documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE FABRICATORS

A. Firms acceptable as fabricators for structural steel Work under this Section shall be members of The American Institute of Steel Construction **(or)** shall be certified by an approved independent professional testing agency as being qualified for Category I Conventional Steel Structures in conformance to the requirements of the AISC Quality Certification Program.

2.2 MATERIALS

A. Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.

B. Rolled Structural Steel Shapes

1. W Shapes: ASTM A992, Fy = 50 ksi
2. Channels, Angles, C, M, HP Shapes, Plates, and Bars: ASTM A 36.

C. Structural Steel Tubular Products

1. Square, Rectangular, and Special Shapes: ASTM A500, Grade B.
2. Round, Structural Steel Pipe: ASTM A53, Type E or S, Grade B.

D. Headed Stud-Type Shear Connectors: ASTM A 108, Grade 1015 or 1020, cold-finished carbon steel with dimensions complying with AISC Specifications.

E. Anchor Bolts: ASTM F1554, Grade 36, nonheaded type unless otherwise indicated.

F. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low-carbon steel bolts and nuts.

3. Provide hexagonal heads and nuts for all connections.
4. Provide either hexagonal or square heads and nuts, except use only hexagonal units for exposed connections.

G. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:

1. Quenched and tempered medium-carbon steel bolts, nuts, and washers, complying with ASTM A 325. Use 3/4-inch bolts, unless noted otherwise on Drawings. Use bearing type connections with threads included in the shear plane.

a. Where indicated as galvanized, provide units that are zinc coated, either mechanically deposited complying with ASTM B 695, Class 50, or hot-dip galvanized complying with ASTM A 153.

2. High-strength fasteners shall be domestically manufactured.

H. Electrodes and Flux for Submerged Arc Welding: AWS Code and ASTM A588, Series A233, Series E60 or E70 as required.

I. Structural Steel Primer Paint: Steel Structures Painting Council (SSPC) - Paint 15.

J. Nonmetallic Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with CE-CRD-C621-89A.

1. Products: Subject to compliance with requirements, provide one of the following:

b. Sure-Grip High Performance Grout; Dayton Superior.
c. Euco N.S.; Euclid Chemical Co.
d. Crystex; L & M Construction Chemicals, Inc.
e. Set Grout; Master Builders.
f. Sealtight 588 Grout; W. R. Meadows.
g. Five Star Grout; U.S. Grout Corp.

K. Masonry Bearing Plates:

1. All joists shall bear on masonry bearing plates with anchor rods embedded in the masonry below. Weld joists to bearing plates in accordance with SJI Specifications. See Framing Details and Plans for bearing plate sizes.
2. All beams shall bear on masonry bearing plates with anchor rods embedded in the masonry below. Weld beams to bearing plates unless otherwise noted.
3. Bearing plates are to be set under Work of Section 04 20 00.

L. Where trusses are indicated with continuous members, they shall be full length without splices or welded with full-penetration shop welds ground flush with grinding in the direction of applied stress and with weld soundness established by radiographic or ultrasonic inspection in accordance with the requirements of 9.2.5.2 or 9.2.5.3 of AWS D1.1 Splices will not be permitted at points of maximum stress. Field splices of tension members shall be designed to develop 110 percent of the spliced sections.

2.3 FABRICATION

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members as shown.

1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

B. Connections: Weld or bolt shop connections, as shown.

1. Bolt field connections, except where welded connections or other connections are indicated.

a. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.
b. Provide unfinished threaded fasteners for only bolted connections of secondary framing members to primary members (including purlins, girts, and other framing members taking only nominal stresses) and for temporary bracing to facilitate erection.

C. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts."

D. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will produce true alignment of axes without warp.
2. Welders to be certified under AWS D1.1 or D1.3 (whichever is applicable) for the position they are welding. An independent CWI to perform the required tests. The CWI shall not be employed or associated with the welding co. Certifications must be current showing passing test with the past 5 years.

E. Built-up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug-weld steel bar stops to frames, except where shown removable. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches o.c., unless otherwise indicated.

F. Holes for Other Work: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on final shop drawings.

G. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.

H. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

I. Expansion Joints: Provide expansion joints in steel shelf angles when part of structural steel frame; locate at vertical brick expansion joints.

2.4 SHOP PAINTING

A. Shop-paint all structural steel work, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel that is partially exposed; paint exposed portions and initial 2 inches of embedded areas only.

1. Do not paint surfaces to be welded or high-strength bolted with friction-type connections.
2. Do not paint surfaces scheduled to receive sprayed-on fireproofing.
3. Coat with tar all steel encased in concrete.

B. Surface Preparation for Exterior Exposed Steel (SSPC - SP 6): After inspection and before shipping, clean all steel work to be painted.

1. Clean all steel scheduled to be exposed and installed in the exterior walls and all steel scheduled to be exposed and installed on the exterior of the building in accordance with

SSPC - SP 6, Commercial Blast Cleaning.

2. Prior to commercial blast cleaning, remove visible oil, grease, soluble welding residue and salts in accordance with SSPC - SP 1, Solvent Cleaning.
3. After commercial blast cleaning and prior to shop painting, remove dirt, dust, and all similar contaminants from the surface.
4. All steel lintels installed in exterior walls shall be hot-dipped galvanized, refer to requirements as specified herein.

C. Surface Preparation for Interior Steel (SSPC - SP 3): After inspection and before shipping, clean steel work to be painted.

1. Clean all steel installed in the interior of the building in accordance with SSPC - SP 3, Power Tool Cleaning.
2. Prior to power tool cleaning, remove visible oil, grease, soluble welding residue and salts in accordance with SSPC - SP 1, Solvent Cleaning.
3. After power tool cleaning and prior to shop painting, remove dirt, dust, and all similar contaminants from the surface.

D. Shop Prime Painting: Immediately after surface preparation, apply structural steel rust inhibited primer paint in accordance with manufacturer's instructions and at rates as specified. Use painting methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Exterior exposed steel receiving the SP 6, Commercial Blast Cleaning, shall be prime painted with primer as follows:

a. Tnemec “90-97 Tneme-Zinc” two-component aromatic urethane zinc-rich primer. Color 90G97 Green. Metallic zinc content shall be 83% by weight in dried film. Lead content shall be less than 0.06% by weight in the dried film as defined in Part 1303 of the Consumer Product Safety Act Regulations. Apply at a rate to achieve a dry film thickness of 2.5 to 3.5 mils.

2. Interior steel receiving the SP 3, Power Tool Cleaning, shall be prime painted with primer as follows:

a. Tnemec “Series 10” primer. Chemically active, rust-inhibitive modified alkyd primer. Color 99G Green. Apply at a rate to achieve a dry film thickness of 2.0 to 3.5 mils.

E. Galvanizing: All steel lintels exposed to the exterior or installed in exterior walls shall be hot-dipped galvanized with a G-90 coating.

2.5 SOURCE QUALITY CONTROL

A. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delays in the work.

1. Promptly notify Architect/Engineer whenever design of members and connections for any portion of structure are not clearly indicated.

B. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
2. Perform visual inspection of all welds.
3. Perform tests of welds as follows. Inspection procedures listed are to be used at Contractor's option.

    a. Liquid Penetrant Inspection: ASTM E 165.
    b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.
    c. Radiographic Inspection: ASTM E 94 and ASTM E 94; minimum quality level "2-2T."
    d. Ultrasonic Inspection: ASTM E 164.

PART 3 - EXECUTION

3.1 INSPECTION

A. Erector must examine the areas and conditions under which structural steel work is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Erector.

3.2 ERECTION

A. Comply with the AISC Specifications and Code of Standard Practice and with specified requirements.

B. Surveys: Employ a licensed land surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with Architect.

C. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

D. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

E. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and rough-in to improve bond to surfaces. Clean the bottom surface of base and bearing plates.

1. Setting Plate Procedure:

    a. Set loose and attached base plates and bearing plates for structural members on

wedges or other adjustable devices.

b. Tighten the anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.

c. Pack bedding grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's instructions, or as otherwise required.

2. Double Nut Procedure

a. Install lower nuts and washers to required elevation.
b. Erect column and install upper nuts and washers.
c. After structure has been erected and plumbed, adjust lower nuts to relieve racking, adjust elevation, and distribute load equally to all anchor bolts.
d. Tighten nuts.
e. Pack bedding grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's instructions, or as otherwise required.

F. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

G. Level and plumb individual members of structure within specified AISC tolerances.

H. Splice members only where indicated and accepted on shop drawings.

I. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

1. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Do not enlarge unfair holes in members by burning or by using drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

J. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

K. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

L. Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint on structural steel is included in Division 9 under painting work.

M. Lintels and Shelf Angles: Weld, bolt, or rivet members together where so indicated.

1. Lintels shall have 8-inch bearing at each end, minimum, unless shown otherwise. Bearing pressures shall not exceed the allowable stress for masonry.
2. Where shelf angles are attached to concrete with bolts and adjustable inserts, provide slotted holes in proper size and spacing in the vertical leg of shelf angles.
3. Loose lintels are not acceptable.

3.3 HIGH STRENGTH STEEL BOLTS

A. Structural joints using high strength bolts, hardened washers, and nuts shall be tightened to a high tension; the materials, methods of installation and tension control, type of wrenches to be used, and inspection methods shall conform to specifications for "Structural Joints using ASTM A325 or A490 Bolts," as approved by the Research Council on Structural Connections of the Engineering Foundation, November 13, 1985.

B. The high strength bolts used shall have a suitable identifying mark placed on top of the head before leaving the factory.

C. Tightening of nuts shall be done by the turn-of-nut method, according to the specifications for "Structural Joints using ASTM A325 or A490 bolts," unless direct tension indicator washers are used, in which case tightening will terminate when proper gap is attained.

D. For turn of the nut method, bolts that have been "Snug-Tight" shall be marked with identifying symbol and then given an additional 1/2 turn. Marks shall be such that visual inspection can be made of finished connections. Snug tight is defined as the tightness developed by the full effort of a man using a spud wrench on all bolts in the connections.

E. High-strength fasteners shall be domestically manufactured.

3.4 ERECTION ALIGNMENT

A. Framing: The framing shall be carried up true, plumb, and level within a tolerance of 1:500; and temporary bracing shall be introduced, wherever necessary, to take care of loads to which the structure may be subjected, including erection equipment and its operation. Such bracing shall be left in place as long as may be required for safety. It shall finally be removed by the Contractor as part of his equipment. As erection progresses, the Work shall be securely connected to take care of dead load, wind, and erection stresses.

3.5 FIELD QUALITY CONTROL

A. Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as necessary to reconfirm any noncompliance of original work and to show compliance of corrected work.

B. Shop-Bolted Connections: Inspect or test in accordance with AISC specifications.

1. Verify that gaps of installed Direct Tension Indicators are less than gaps specified in ASTM F 959, Table 2.

C. Field-Bolted Connections: Inspect in accordance with AISC specifications.

1. For Direct Tension Indicators, comply with requirements of ASTM F 959. Verify that gaps are less than gaps specified in Table 2.

D. Field Welding: Inspect and test during erection of structural steel as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
2. Perform visual inspection of all welds.
3. Perform tests of welds as follows:

    a. Liquid Penetrant Inspection: ASTM E 165.
    b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.
    c. Radiographic Inspection: ASTM E 94, minimum quality level "2-2T."
    d. Ultrasonic Inspection: ASTM E 164.

END OF SECTION 05 12 00

SECTION 05 21 00
STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes steel joists and joist girders for floor and roof framing. Types of joists required include the following:

1. K-Series Open Web Steel Joists.
2. LH-Series Longspan Steel Joists.
3. Top Chord Double Pitch

B. When outriggers, angles, or other components are attached to the open web steel joists in the shop in such a way that they actually are a component part of the joists, they are to be provided under this Section.

C. The Work includes bridging anchors, sag rods, wall anchors, and beam anchors.

D. Related Work: Ends of joists resting on masonry require steel bearing plates furnished under Section 05 50 00 and installed under Section 04 20 00 over a leveling bed of mortar.

1. Include manufacturer's certification that joists comply with SJI "Specifications."

1.2 SUBMITTALS

A. Product data and installation instructions for each type of joist and accessories.

1. Include manufacturer's certification that joists comply with SJI "Specifications."
2. Certification from joist manufacturer that joists are properly designed and will be furnished to meet live loads, dead loads, wind loads (including uplift), and slope conditions indicated on the Drawings.

B. Complete shop drawings by approved fabricator including plan layouts of columns and anchor bolt locations, erection diagrams, and shop detail drawings. Symbols and indications used for structural components on design drawings must appear identically on submitted shop drawings. Types of electrodes proposed for welding processes must also appear thereon.

1. Provide templates or location drawings for installation of anchor bolts and metal bearing plates.
2. Shop drawing packages shall be by building submitted in sequence corresponding to Construction Manager’s building construction schedule.

C. Letter from a Professional Engineer licensed within the State of construction activities certifying that he has carefully studied the design drawings, that shop drawings have been prepared under his direct guidance and supervision, and that provided components and connections will meet or exceed loading requirements. Such letter of certification must be evidenced by Engineer's full signature and seal of authenticity. Architect/Engineer's review of shop drawings will not begin

until such certification has been received.

1.3 QUALITY ASSURANCE

A. Provide joists fabricated in compliance with the following and as herein specified.

1. SJI "Standard Specifications and Load Tables" for K, LH, and DLH Series Open Web Steel Joists, latest edition, sizes as indicated on the Drawings.
2. Comply with Factory Mutual requirements.

B. Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with AWS "Qualification" requirements.

1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests. Documentation of current certification is required.
2. If re-certification of welders is required, retesting will be Contractor's responsibility.

C. Inspection: Inspect joists and girders in accordance with SJI "Specifications."

D. The deflection of floors and roofs with plaster ceiling or soffits suspended or attached, due to the design live load, shall not exceed 1/360 of the span; other roofs, not to exceed 1/240 of the span.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel joists as recommended in SJI and AISC "Standard Specifications," in a manner to avoid excessive stresses deforming members.

B. Bent joist members or broken welds shall be cause for joist rejection. Rejected joists shall be replaced without delay.

1.5 JOB CONDITIONS

A. During the construction period, Contractors shall provide means for the adequate distribution of concentrated loads so that the carrying capacity of any joist is not exceeded.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Member firms of the Steel Joist Institute will be acceptable manufacturers of steel joist specified herein.

2.2 MATERIALS

A. Steel: Comply with SJI and AISC "Standard Specifications."

1. Yield strength used as a basis for the design stresses shall be as follows:

   - Chords = 50,000 psi
   - Webs = 36,000 psi or 50,000 psi

2. Evidence that the steel furnished meets or exceeds the design yield strength shall be provided, on Architect's request, in the form of certified test reports.
3. Deduct the area of holes in chords from the area of the chord when calculating the strength of the member.

B. Steel Bearing Plates: ASTM A 36.

C. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular hexagon type, low carbon steel.

D. Paint: Comply with SJI and AISC "Standard Specifications," except asphalt type paint is not permitted. Provide Type I, red oxide, steel joist shop paint conforming to Steel Structure Painting Council (SSPC) - Paint 15.

1. Do not apply primer paint to joists indicated to receive sprayed-on fireproofing.

2.3 FABRICATION

A. General: Fabricate steel joists in accordance with SJI and AISC "Standard Specifications," and as follows:

1. Make shop connections and splices using either arc or resistance welding. Shop-bolted connections are not acceptable.
2. Do not splice web members; use only full-length pieces.
3. Top and bottom chords shall be uniform size throughout their full length.
4. Do not splice bottom chord members in the middle third of the span.
5. Splices in bottom chord members shall be certified by the joist fabricator to provide 100 percent of the strength of the chord section used.

B. Holes in Chord Members: Provide holes in chord members where shown for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.

C. Extended End: Provide extended ends on joists where indicated, complying with SJI "Specifications" and load tables.

D. Ceiling Extension: Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface, unless otherwise indicated.

E. Top Chord Extension: Provide top chord extensions ("R" type) on joists where indicated, complying with SJI "Specifications" and load tables.

F. Bridging: Provide horizontal or diagonal type bridging for joists and joist girders, complying with SJI "Specifications." Provide bridging anchors for ends of bridging lines terminating at walls or beams.

G. End Anchorage: Provide end anchorages, including steel bearing plates, to secure joists to adjacent construction, complying with SJI "Specifications."

H. Header Units: Provide header units to support tail joists at openings in floor or roof system not framed with steel shapes.

I. Top Chords: Shall be absolutely flat across its full width and length for application of metal decking.

J. Bottom Chords: Shall be extended and connected to columns or webs of girders at column lines and where shown on structural drawings.

K. Joist Ends: Shall be beveled when slope exceeds 1/4 inch in 12 inch or sloped shoes shall be provided.

L. Shop Painting:

1. Remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories before application of shop paint.
2. Apply one shop coat of steel primer paint to steel joists and accessories by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 1.0 mil.

PART 3 - EXECUTION

3.1 PREPARATION

A. Roof joist anchorage shall be designed to resist gross uplift force indicated on the Drawings.

B. Joist anchorage for un-enclosed areas and roof overhangs shall be designed to the upward pressure indicated on the Drawings.

3.2 ERECTION

A. Place and secure steel joists in accordance with SJI "Specifications," final shop drawings, and as herein specified.

B. Anchors: Furnish anchor bolts, steel bearing plates, and other devices to be built into concrete and masonry construction.

1. Provide unfinished threaded fasteners for anchor bolts, unless high strength bolts indicated.

C. Placing Joists: Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening.

D. Provide temporary bridging, connections, and anchors to ensure lateral stability during

construction.

E. Bridging: Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.

F. Fastening Joists: Comply with the following:

1. Field weld joists to supporting steel framework and steel bearing plates where indicated in accordance with SJI "Specifications" for type of joists used. Coordinate welding sequence and procedure with placing of joists.
2. Bolt joists to supporting steel framework in accordance with SJI "Specifications" for type of joists used.

    a. Use unfinished threaded fasteners for bolted connections, unless otherwise indicated.

G. End Anchorage

1. At steel supports the joist ends shall extend not less than 2-1/2 inches over beams.
2. At masonry the joist ends shall extend not less than 4 inches over walls. The center line of bearing the joist shall coincide with the center line of the masonry bearing plate and the masonry wythe on which it bears, except where 2 joists from opposite sides bear on the same wythe.
3. Ends shall be anchored with the equivalent of two 3/16-inch fillet welds 1-1/2 inches long or two 1/2-inch bolts.

H. Field Welding

1. The total length of weld at a cross-section shall not exceed 50 percent of the overall developed width of cold-formed members.
2. Extreme caution must be exercised during welding. Completely cover and protect masonry and concrete in place from damage during welding.

I. Touch-Up Painting: After joist installation, paint field bolt heads and nuts and abraded or rusty surfaces on joists and steel supporting members. Wire brush surfaces and clean with solvent before painting. Use the same type of paint as used for shop painting.

END OF SECTION 05 21 00

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SECTION 05 31 00
STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes steel deck units for floor and roof applications.

1. Metal roof deck units.
2. Acoustical metal roof deck units.
3. Metal floor deck units.

B. Related Work

1. The cutting, drilling, or punching of openings smaller than 12 by 12 inches for passage of pipes, ducts, and the attachment of other items shall be performed in the field by the respective trades requiring same.
2. For openings 12 by 12 inches and larger, each shall be predetermined and provided or cut under this Section. Steel framing members indicated or required around openings 12 by 12 inches and larger through decks shall be provided and erected under Section 05 12 00.
3. Installation of sound absorbing material for acoustical deck is included under Roofing Sections of Division 07.

1.2 SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for each type of decking and accessories.

1. Provide test data for mechanical fasteners used in lieu of welding for fastening deck to supporting structures.

B. Shop Drawings: Show layout and types of deck units, anchorage details, and conditions requiring closure strips, supplementary framing, sump pans, cant strips, cut openings, special jointing, and accessories.

C. Calculations prepared and signed and sealed by a Florida Registered Engineer showing required roof deck fastening patterns for combined wind uplift and diaphragm shear forces shown on the Structural Drawings. Type, size, and spacing of fasteners shall be included in calculations.

D. Preinstallation Conference minutes

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise indicated:

1. American Iron and Steel Institute (AISI), "Specification for the Design of Cold-Formed Steel Structural Members."
2. American Welding Society (AWS), D1.3 "Structural Welding Code - Sheet Steel."
3. Steel Deck Institute (SDI), "Design Manual for Composite Decks, Form Decks and Roof Decks."

B. Qualification of Field Welding: Use qualified welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS.

1. Welded decking in place is subject to inspection and testing. Owner will bear expense of removing and replacing portions of decking for testing purposes if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work.

C. Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.

1. Provide cellular floor deck units listed in UL "Electrical Construction Materials Directory" with each cellular metal floor deck unit bearing UL labels and marking. Provide units that will permit use of standard header ducts and outlets for electrical distribution systems.

D. Design Criteria:

1. Compute the properties of metal roof deck sections on the basis of the effective design width as limited by the provisions of the SDI specifications. Provide the deck section properties, including section modulus and moment of inertia per foot of width.
2. Allowable Deflection: Design and fabricate deck for a maximum deflection of 1/240 of the clear span under the uniform live load.

E. Preinstallation Conference: Prior to steel deck installation, conduct a preinstallation conference at the project site with the contractor and Architect. Refer to Section 01 31 19, Project Meetings, for preinstallation conference requirements. Submit preinstallation conference meeting minutes as specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Vulcraft Div., Nucor Corp.
2. New Millennium Building Systems
3. Canam Steel Corp.

2.2 MATERIALS

A. Steel for Galvanized Metal Deck Units: ASTM A 653, grade as required to comply with SDI specifications.

B. Miscellaneous Steel Shapes: ASTM A 36.

C. Shear Connectors: Headed stud type, ASTM A 108, Grade 1015 or 1020, cold-finished carbon steel, with dimensions complying with AISC specifications.

D. Shear Connectors: Strap type, ASTM A 1011, Grade D, hot-rolled carbon steel.

E. Sheet Metal Accessories: ASTM A 653, commercial quality, galvanized.

F. Galvanizing: ASTM A 653, G90 (.90 oz. per sq.ft.).

G. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

H. Flexible Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.

I. Acoustic Sound Barrier Closures: Manufacturer’s standard mineral fiber closures.

J. Self-Drilling Screws: Hilti self-drilling screws or approved equal.

K. Powder Actuated Fasteners: Hilti X-ENP-19 L15 pins or approved equal.

2.3 FABRICATION

A. General: Form deck units in lengths to span multiple supports as indicated on the Drawings, with flush, telescoped, or nested 2-inch laps at ends and interlocking or nested side laps of metal thickness depth and width as indicated.

B. Metal Roof Deck Units: Provide deck configurations that comply with SDI “Specifications and Commentary for Steel Roof Deck.”

1. Provide type, depth, and gage as indicated on the Drawings. Finish shall be galvanized G90.
2. Roofdeck shall be vented 0.5% for cellular lightweight insulating concrete roofing as required by FBC section 1917.4.1 and 1917.1.1.1.

C. Corrugated Metal Form Deck Units:

1. Provide type, depth, and gage as indicated on the Drawings. Finish shall be galvanized G90.
2. Panel end joints are to be lapped a minimum of 2 inches.
3. Sidelaps are to be nestable, overlapping type.

D. Acoustical Roof Deck Units:

1. Provide type, depth and gage as indicated on the Drawings. Finish shall be galvanized G90.
2. Single-pan units: Single-pan fluted units with vertical webs perforated with approximate 5/32-inch diameter holes staggered 3/8-inch o.c. Provide mineral fiber acoustical insulation strips of profile to fit void space between vertical ribs.
3. Multiple-pan cellular units: Composite units consisting of upper fluted section combined with lower flat plate section having interlocking side laps and approximate 5/32-inch perforations staggered on 3/8-inch centers under cells formed by upper unit. Provide mineral fiber acoustical insulation strips of profile to fit void space of each cell.
4. Provide perforations on vertical webs of standard roof deck units and provide NRC of .80 or better.
5. Furnish manufacturer's standard inorganic, mineral fiber acoustical insulation strips of profile to fit void space.
6. Installation of sound absorption material is under Division 07.

E. Metal Floor Deck Units: Provide deck configurations that comply with SDI requirements. Provide galvanized G90 composite metal deck as specified by SDI and gage as indicated on Drawings.

F. Metal Cover Plates: Fabricate metal cover plates for end-abutting floor deck units of not less than same thickness as decking. Form to match contour of deck units and approximately 6 inches wide.

G. Metal Closure Strips: Fabricate metal closure strips for cell raceways and openings between decking and other construction of not less than 0.045-inch min. (18 gage) sheet steel. Form to provide tight-fitting closures at open ends of cells or flutes and sides of decking.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which metal decking items are to be installed. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install deck units and accessories in accordance with manufacturer's recommendations, shop drawings, and as specified.

B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.

1. Do not start placement of deck units before supporting members are installed. Place deck units on supporting metal steel framework and adjust to final position with ends bearing on supporting members and accurately aligned end to end before being permanently fastened.

a. Lap ends 1-1/2-inch deck units not less than 2 inches.
b. Butt ends of 3-inch deck units.
c. Do not stretch or compress the side-lap interlocks.
d. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.

C. Align deck units for entire length of run of cells and with close alignment between cells at ends of abutting units.

D. Place deck units flat and square, secured to adjacent framing without warp or deflection.

E. Do not place deck units on concrete supporting structure until concrete has cured and is dry.

F. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

G. Attach deck to supports and install side lap fasteners as indicated.

1. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work. Use welding washers where recommended by deck manufacturer.
2. Mechanical fasteners, either powder-actuated or pneumatically driven, may be used in lieu of welding. Locate mechanical fasteners and install in accordance with deck manufacturer's instructions. Substituted fasteners must have equivalent strength and characteristics of specified fasteners or welds.

H. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown.

I. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

J. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units, except where taped joints are required.

K. Shear Connectors: Weld shear connectors to supports through decking units in accordance with manufacturer's instructions. Do not weld shear connectors through two layers (lapped ends) of decking units. Weld only on clean, dry deck surfaces.

L. Closure Strips: Provide metal closure strips at open uncovered ends and edges of roof decking and in voids between decking and other construction. Weld into position to provide a complete decking installation.

1. Provide flexible closure strips instead of metal closures, at Contractor's option, wherever their use will ensure complete closure. Install with adhesive in accordance with manufacturer's instructions.

M. Touch-Up Painting: After decking installation, wire brush, clean, and paint scarred areas, welds, and rust spots on top and bottom surfaces of decking units and supporting steel members.

1. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.
2. In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

N. Ridge and Valley Plates: Weld ridge and valley plates to the top surface of the roof decking. Lap end joints not less than 3 inches, with laps made in the direction of water flow.

O. Repair:

1. Holes up to 1/2 inch in diameter fill with urethane or silicone sealant and cover with duct tape.
2. Holes above 1/2-inch diameter require sheet metal plate patches fastened to deck.

3.3 SUPPORT OF OTHER WORK

A. Suspension wires, straps, and chains such as those used to support acoustical ceilings, ductwork, and lights shall not be attached to or through steel roof decks.

B. Composite floor deck units are not designed to support the weight of concrete placing equipment such as self-propelled power (laser) screeds, and use of such equipment is strictly prohibited.

END OF SECTION 05 31 00

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Types of cold-formed metal framing units include the following:

1. Exterior wall, fascia, soffit and ceiling studs.
2. Exterior hat channels.
3. Exterior angles, bent plates and miscellaneous units necessary to support the architectural finishes.

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B. Related Work Specified Elsewhere:

1. Metal studs and accessories for gypsum wallboard included under Work of Section 09 20 00.

1.2 SUBMITTALS

A. Submit in accordance with Division 1 requirements.

B. Product data and installation instructions for each item of cold-formed metal framing and accessories.

C. Shop drawings for special components and installations not fully dimensioned or detailed in manufacturer's product data.

1. Include engineered placing drawings for framing members showing size and gage designations, number, type, location, and spacing. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for proper installation. Submittals shall bear the signature and seal of the Florida professional engineer who was in responsible charge of their preparation.

1.3 QUALITY ASSURANCE

A. Component Design: Calculate structural properties of studs and joists in accordance with American Iron and Steel Institute (AISI) "Specification for Design of Cold-Formed Steel Structural Members."

B. Welding: Use qualified welders and comply with American Welding Society (AWS) D1.3, "Structural Welding Code - Sheet Steel."

1. Field welding of studs shall not be permitted.

C. Fire-Rated Assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units that have been approved by governing authorities that have jurisdiction.

D. Pre-Installation Conference: Prior to start of installation of metal framing systems, meet at project site with installers of other work. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.

E. The following documents of the issue in effect on date of material procurement, referred to thereafter by basic designation only, form a part of this Specification to the extent indicated by reference thereto.

1. Specification for the Design of Cold-Formed Steel Structural Members, American Iron and Steel Institute.
2. ASTM A653/A653M - Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
3. ASTM A1011/A1011M - Specification for Hot-Rolled Carbon Steel Sheets and Strip, Structural Quality.
4. ASTM A1008/A1008M - Specification for Steel, Cold-Rolled Sheet, Carbon Structural.
5. MFMA (Metal Framing Manufacturers Association) - Guidelines for the Use of Metal Framing.

1.4 DELIVERY AND STORAGE

A. Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type, and grade. Store off ground in a dry ventilated space or protect with suitable waterproof coverings.

PART 2 - PRODUCTS

2.1 STRUCTURAL DESIGN

A. Design, analysis, and computation of section properties shall be in conformance with the Specification for the Design of Cold-Formed Steel Structural Members of the American Iron and Steel Institute.

B. Technical tabulations of section properties and load capacities shall indicate dimensions, steel characteristics, and allowable stresses upon which computations are based.

C. Structural calculations of the specific members required to provide a complete assembly shall be performed based upon the wind load pressures and suctions as indicated in the drawings in addition to well established and documented dead loads as required for the specific situations. Deflections shall be limited to L/600 for masonry finishes, L/360 for stucco finishes and L/240 for EIFS finishes. Submittals shall be prepared based upon the finishes as indicated in the architectural drawings and the available structure to attach to as indicated in the structural drawings.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Ram Steel Framing, Inc.
2. ClarkDietrich Building Systems
3. Marino\WARE 800-627-4661 info@marinoware.com

2.3 METAL FRAMING

A. System Components: Manufacturers' standard steel studs and joists of type, size, shape, and gage as indicated. With each type of metal framing required, provide manufacturer's standard, steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories for applications indicated, as needed to provide a complete metal framing system. Provide manufacturer's recommended "slip" connection where the deflections of overhead decking or structural members may cause an axial load to be imposed on the steel studs.

1. Vertical Deflection Clips: Manufacturer's standard [bypass] [head] clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web. Required use of connection products that have a valid ICC ES Report or equivalent complying with ICC Acceptance Criteria AC261. The Steel Network, Inc.: VertiClip® and VertiTrack® (ICC #ESR-1903) or approved equivalent.

B. Materials and Finishes:

1. Steel Studs: Fabricate metal framing components of structural quality steel sheet with a minimum yield point of 40,000 psi; ASTM A 653, A 1011, or A 1008.
2. Provide galvanized finish to metal framing components complying with ASTM A 653 for minimum: G 60 coating interior framing, G 90 coating exterior framing.
3. Fasteners: Provide nuts, bolts, washers, screws, and other fasteners with corrosion-resistant plated finish. Where exposed to weather provide galvanized fasteners.
4. Electrodes for Welding: Comply with AWS Code and as recommended by stud manufacturer.
5. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

2.4 FABRICATION

A. General: Framing components may be prefabricated into assemblies before erection. Fabricate panels plumb, square, true to line, and braced against racking with joints welded. Perform lifting of prefabricated units to prevent damage or distortion.

B. Fabricate units in jig templates to hold members in proper alignment and position and to assure consistent component placement.

C. Fastenings: Attach similar components by shop welding or field installed screw fasteners. Attach dissimilar components by shop welding or field bolting/screwing, as standard with manufacturer.

D. Wire tying of framing components is not permitted.

E. Fabrication Tolerances: Fabricate units to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet.

PART 3 - EXECUTION

3.1 INSPECTION

A. Pre-installation Conference: Prior to start of installation of metal framing systems, meet at project site with installers of other work including ceiling grid systems and mechanical and electrical work. Review areas of potential interference and conflicts and coordinate layout and support provisions for interfacing work.

3.2 INSTALLATION

A. Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations and in conformance with the engineered and approved submittals.

B. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24 inches o.c. spacing for nail or power-driven fasteners or 16 inches o.c. for other types of attachment. Provide fasteners at corners and ends of tracks. All runner tracks shall be at least the same gauge metal as the steel stud it attaches to. All attachments of the runner tracks to the building construction shall be designed to withstand dead and wind loads. Steel studs shall be attached to runner tracks on both faces of runner track.

C. Installation of Studs: Secure studs to runner tracks at both inside and outside flanges. Secure studs to each other at intersections. Secure studs to the structure.

D. Hat Channels: Secure hat channels to studs and to the structure.

E. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

F. Where stud system abuts structural columns or walls, including masonry and/or tilt-up concrete walls, anchor ends of stiffeners to supporting structure.

G. Install supplementary framing, blocking, and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

H. Frame wall openings larger than 2 feet square with double stud at each jamb of frame except where more than two are either shown or indicated in the engineered submittals. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure stud

system wall opening frame in manner indicated.

1. Contractor's option to reduce or eliminate multiple studs at jambs and headers: JamStud as manufactured by the Steel Network, Inc. ASTM A653/A653M, Grade 50 (340), 50ksi (340MPa), minimum yield strength, 65ksi (450 MPa), minimum tensile strength, G-60 (Z180) hot-dipped galvanized coating.
2. Approved Engineered Connections for attachment of jambs to headers: StiffClip HE and StiffClip AL as manufactured by The Steel Network, Inc.

I. Frame both sides of expansion and control joints with separate studs; do not bridge the joint with components of stud system.

J. Install horizontal stiffeners in stud system, spaced (vertical distance) at not more than 54 inches o.c.

K. Erection Tolerances: Bolt or weld wall panels (at both horizontal and vertical junctures) to produce flush, even, true-to-line joints.

1. Maximum variation in plane and true position between prefabricated assemblies should not exceed 1/16 inch.

L. Field Painting: Touch-up damaged shop-applied protective coatings. Use compatible primer for prime-coated surfaces; use galvanizing repair system for galvanized surfaces.

END OF SECTION 05 40 00

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel tube reinforcement for low partitions.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Elevator machine beams and hoist beams.
4. Steel shapes for supporting elevator door sills.
5. Metal ladders.
6. Alternating tread devices.
7. Ladder safety cages.
8. Metal floor plate and supports.
9. Elevator pit sump covers.
10. Metal bollards.
11. Abrasive metal nosings.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
3. Manufactured metal ladders.
4. Alternating tread devices.
5. Grout.
6. Abrasive metal nosings.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel tube reinforcement for low partitions.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Elevator machine beams, hoist beams, and divider beams.
4. Steel shapes for supporting elevator door sills.
5. Alternating tread devices.
6. Metal ladders.
7. Metal floor plate and supports.
8. Elevator pit sump covers.
9. Metal bollards.

C. Samples for Verification: For each type and finish of extruded nosing.

D. Delegated-Design Submittal: For ladders, safety cages, alternating tread devices and attachments, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design ladders, safety cages, alternating tread devices and attachments.

B. Structural Performance of Aluminum Ladders: Ladders, including landings, are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI/ASC A14.3.

C. Structural Performance of Alternating Tread Devices: Alternating tread devices are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Alternating Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Comply with applicable railing loadings in Section 055213 "Pipe and Tube Railings."

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

D. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

E. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

F. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

G. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

H. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

I. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

J. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M,Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 91 00 "Painting."

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

2.7 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders for interior use:

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 1-inch-diameter steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inchin least dimension.
7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
8. Galvanize and prime exterior ladders, including brackets.
9. Prime ladders, including brackets and fasteners, with primer specified in Section 09 91 00 "Painting."

C. Aluminum Ladders for exterior use:

1. Source Limitations: Obtain aluminum ladders from single source from single manufacturer.
2. Space siderails 18 inches apart unless otherwise indicated.
3. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
4. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
5. Fit rungs in centerline of siderails; fasten by welding or with stainless steel fasteners or brackets and aluminum rivets.
6. Provide platforms as indicated fabricated from pressure-locked aluminum bar grating or extruded-aluminum plank grating, supported by extruded-aluminum framing. Limit openings in gratings to no more than 1/2 inch in least dimension.

7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted aluminum brackets.
8. Provide minimum 72-inch-high, hinged security door with padlock hasp at foot of ladder to prevent unauthorized ladder use.

2.8 LADDER SAFETY CAGES

A. General:

1. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless steel fasteners.
2. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet o.c. Provide secondary intermediate hoops spaced not more than 48 inches o.c. between primary hoops.
3. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless steel fasteners unless otherwise indicated.

B. Steel Ladder Safety Cages for interior use:

1. Primary Hoops: 1/4-by-4-inch flat bar hoops.
2. Secondary Intermediate Hoops: 1/4-by-2-inch flat bar hoops.
3. Vertical Bars: 3/16-by-1-1/2-inch flat bars secured to each hoop.
4. Galvanize and prime ladder safety cages, including brackets and fasteners.

C. Aluminum Ladder Safety Cages for exterior use:

1. Primary Hoops: 1/4-by-4-inch flat bar hoops.
2. Secondary Intermediate Hoops: 1/4-by-2-inch flat bar hoops.
3. Vertical Bars: 1/4-by-2-inch flat bars secured to each hoop.
4. Galvanize and prime ladder safety cages, including brackets and fasteners.

2.9 ALTERNATING TREAD DEVICES

A. Alternating Tread Devices: Fabricate alternating tread devices of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.

1. Tread depth is not to be less than 5 inches exclusive of nosing or less than 8-1/2 inches, including the nosing, tread width is not to be less than 7 inches, and riser height is not to be more than 9-1/2 inches.
2. Tread depth is not to be less than 8-1/2 inches exclusive of nosing or less than 10-1/2 inches, including the nosing, tread width is not to be less than 7 inches, and riser height is not to be more than 8 inches.
3. Fabricate from steel and assemble by welding or with stainless steel fasteners.
4. Comply with applicable railing requirements in Section 05 52 13 "Pipe and Tube Railings."

B. Prime steel alternating tread devices, including treads, railings, brackets, and fasteners, with primer specified in Section 09 91 00 "Painting."

2.10 METAL FLOOR PLATE

A. Fabricate from rolled-aluminum-alloy tread abrasive-surface floor plate of thickness indicated below:

1. Thickness: 1/4 inch.

B. Include aluminum angle stiffeners, and fixed and removable sections as indicated.

2.11 ELEVATOR PIT SUMP COVERS

A. Fabricate from 3/16-inch abrasive-surface floor plate with four 1-inch-diameter holes for water drainage and for lifting.

B. Provide steel angle supports as indicated.

2.12 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe.

1. Cap bollards with 1/4-inch-thick steel plate.
2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.

B. Fabricate bollards with 3/8-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

C. Prime bollards with primer specified in Section 09 10 00 "Painting."

2.13 ABRASIVE METAL NOSINGS

A. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Safety Tread Co., Inc.
b. Balco; a CSW Industrials Company.
c. Nystrom.

2. Source Limitations: Obtain units from single source from single manufacturer.
3. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
4. Nosings:

a. Square-back units, 4 inches wide, for casting into concrete steps.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply clear lacquer to concealed surfaces of extruded units.

2.14 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Section 09 91 00 "Painting" unless indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.16 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLING METAL BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.4 INSTALLATION OF NOSINGS, TREADS, AND THRESHOLDS

A. Center nosings on tread widths unless otherwise indicated.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 00 "Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

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SECTION 05 51 13
METAL PAN STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.
2. Steel tube railings attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.
4. Abrasive metal nosings.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs and railings.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete or masonry.
2. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

D. Schedule installation of railings so wall attachments are made only to completed walls.

1. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For metal pan stairs and the following:

1. Abrasive nosings.
2. Shop primer products.
3. Handrail wall brackets.
4. Grout.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.
5. Abrasive metal nosings.

C. Samples for Verification: For each type and finish of nosing.

D. Delegated-Design Submittal: For stairs, railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.

1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect steel members and packaged materials from corrosion and deterioration.
3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

    a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design stairs, railings, including attachment to building construction.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

C. Structural Performance of Railings: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Tubing for Railings: ASTM A500/A500M (cold formed) or ASTM A513/A513M.

D. Uncoated, Hot-Rolled Steel Sheet: ASTM A1011/A1011M, structural steel, Grade 30, unless another grade is required by design loads.

2.3 ABRASIVE METAL NOSINGS

A. Fabricate units of material, sizes, and configurations indicated. Provide extruded aluminum units with abrasive filler consisting of aluminum-oxide or silicon-carbide grits, or a combination of both, in an epoxy-resin binder. Furnish in lengths as required to accurately fit each opening or conditions.

1. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above the aluminum extrusion.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Safety Tread Co., Inc.
2. Amstep Products.
3. Armstrong Products, Inc.
4. Balco/Metalines, Inc.
5. Wooster Products Inc.

C. Provide integral anchors for embedding units in concrete.

D. Apply clear lacquer to concealed surfaces of extruded units.

2.4 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 where built into exterior walls.

1. Select fasteners for type, grade, and class required.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

2.5 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Shop Primers: Provide primers that comply with Section 09 91 00 "Painting."

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

D. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Assemble stairs and railings in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 - Completely sanded joint with some undercutting and pinholes okay.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that will be exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.7 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Commercial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers as indicated on Drawings.

a. Stringer Size: As required to comply with "Performance Requirements" Article.
b. Provide closures for exposed ends of channel and rectangular tube stringers.
c. Finish: Shop primed.

2. Construct platforms of steel plate or channel or rectangular tube headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.

a. Provide closures for exposed ends of channel and rectangular tube framing.
b. Finish: Shop primed.

3. Weld stringers to headers; weld framing members to stringers and headers.
4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below.

a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.

1. Fabricate treads and landing subplatforms of exterior stairs so finished walking surfaces slope to drain.
2. Steel Sheet: Uncoated, cold-rolled steel sheet.
3. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
4. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
5. Shape metal pans to include nosing integral with riser.
6. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.
7. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.8 FABRICATION OF STAIR RAILINGS

A. Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: As Indicated.
2. Picket Infill: As Indicated.
3. Intermediate Rails Infill: As Indicated.

B. Welded Connections: Fabricate railings with welded connections.

1. Fabricate connections that are exposed to weather in a manner that excludes water.

    a. Provide weep holes where water may accumulate internally.

2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
3. Weld all around at connections, including at fittings.
4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
5. Obtain fusion without undercut or overlap.
6. Remove flux immediately.
7. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 - Completely sanded joint, some undercutting and pinholes are okay as shown in NAAMM AMP 521.

C. Form changes in direction of railings as follows:

1. By bending or by inserting prefabricated elbow fittings.

D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

G. Connect posts to stair framing by direct welding unless otherwise indicated.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
3. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.

1. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.9 FINISHES

A. Finish metal stairs after assembly.

B. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal stair components, except those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.

1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.

a. Clean bottom surface of plates.
b. Set plates for structural members on wedges, shims, or setting nuts.
c. Tighten anchor bolts after supported members have been positioned and plumbed.
d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.

1) Neatly finish exposed surfaces; protect grout and allow to cure.
2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
2. Comply with requirements for welding in "Fabrication, General" Article.

F. Place and finish concrete fill for treads and platforms to comply with Section 03 30 00 "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete.
2. Center nosings on tread width.

3.3 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.

1. Space posts at spacing indicated or, if not indicated, as required by design loads.
2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
4. Secure posts and rail ends to building construction as follows:

a. Anchor posts to steel by welding to steel supporting members.
b. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with post-installed anchors and bolts.

B. Attach handrails to wall with wall brackets.

1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
2. Secure wall brackets to building construction as required to comply with performance requirements.

a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
b. For hollow masonry anchorage, use toggle bolts.
c. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.4 REPAIR

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 00 "Painting."

END OF SECTION 05 51 13

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SECTION 05 52 13
PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel pipe and tube railings.
2. Aluminum pipe and tube railings.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

a. Show method of connecting members at intersections.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

D. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

E. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.4 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Minimum of 1-1/4” inside diameter or 1-1/2” outside diameter

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.5 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Tubing: ASTM B 221, Alloy 6063-T5/T52.

C. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
2. Minimum of 1-1/4” inside diameter or 1-1/2” outside diameter

D. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.

E. Plate and Sheet: ASTM B 209, Alloy 6061-T6.

2.6 FASTENERS

A. General: Provide the following:

1. Ungalvanized-Steel Railings - Interior use only: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
2. Aluminum Railings: Type 304 stainless-steel fasteners.
3. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.7 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Shop Primers: Provide primers that comply with Section 09 91 00 "Painting"

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.8 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

J. Form Changes in Direction as Follows:

1. By bending or by inserting prefabricated elbow fittings.

K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. For removable railing posts, fabricate slip-fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.

1. Provide socket covers designed and fabricated to resist being dislodged.
2. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.9 STEEL AND IRON FINISHES

A. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, and fasteners; however, galvanize anchors to be embedded in exterior concrete or masonry.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:

1. Railings Indicated to Receive Primers Specified in Section 09 91 00 "Painting": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated railings with primers specified in Section 09 91 00 "Painting."

2.10 ALUMINUM FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

C. Leave anchorage joint exposed with anchoring material flush with adjacent surface.

D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
2. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

E. Install removable railing sections, where indicated, in slip-fit stainless steel sockets cast in concrete.

3.5 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

C. Attach railings to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 00 "Painting."

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 05 52 13

Division 06

Wood, Plastics and Composites

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SECTION 06 10 53
MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wood blocking, cants, and nailers.
2. Wood furring and grounds.
3. Wood sleepers.
4. Plywood backing panels.

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Power-driven fasteners.
3. Post-installed anchors.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat all miscellaneous carpentry unless otherwise indicated.

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Cants.
4. Furring.
5. Grounds.

B. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

D. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, C-C Plugged, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Screws for Fastening to Metal Framing: ASTM C1002 or ASTM C954, length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

H. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

I. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILER

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 53

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SECTION 06 16 00
SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall sheathing.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Georgia-Pacific Building Products; Dens-Glass Gold. or a comparable product by one of the following:

    a. CertainTeed Corporation.
    b. National Gypsum Company.
    c. United States Gypsum Company.

2. Thickness: 5/8-inch.
3. Size: 48 by 96 inches.

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For wall and parapet sheathing, provide Type 316 Stainless Steel fasteners.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

2.3 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Florida Building Code - Current Edition.
2. ICC-ES evaluation report for fastener.

D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

E. Coordinate wall and parapet sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
4. Install panels with a 1/8-inch or as required by the Manufacturer of applied Weather Barriers."

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

E. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.

END OF SECTION 06 16 00

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SECTION 06 40 23
INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior standing and running trim.

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For interior architectural woodwork.

1. Include plans, elevations, sections, and attachment details.
2. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 INTERIOR ARCHITECTURAL WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Custom.

B. Hardwood Lumber:

1. Wood Species and Cut: As indicated on the Interior Finish Schedule.
2. Wood Moisture Content: 8 to 13 percent.
3. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
4. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.

a. For veneered base, use hardwood lumber core, glued for width.

5. For base wider than available lumber, glue for width. Do not use veneered construction.
6. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.

C. Softwood Lumber:

1. Wood Species and Cut: As indicated on the Interior Finish Schedule.
2. Wood Moisture Content: 8 to 13 percent.
3. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
4. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.

a. For veneered base, use softwood lumber core, glued for width.

5. For base wider than available lumber, glue for width. Do not use veneered construction.
6. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.
7. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.

2.3 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Architectural Woodwork Standards Grade: Premium.

1. Wood Species: Any closed-grain hardwood.
2. Wood Moisture Content: 8 to 13 percent.

2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 8 to 13 percent.

2.5 FABRICATION

A. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

2.6 MISCELLANEOUS MATERIALS

A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

B. Adhesives: Do not use adhesives that contain urea formaldehyde.

C. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

1. Adhesives shall have a VOC content of 70 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.7 FABRICATION

A. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
2. Edges of Rails and Similar Members More Than 3/4-Inch-Thick: 1/8 inch.

2.8 SHOP PRIMING

A. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

B. Interior Architectural Woodwork for Opaque Finish: Shop prime with one coat of wood primer as specified in Section 09 91 00 "Painting."

1. Backpriming: Apply one coat of primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

2.9 FINISHING

A. Opaque Finish: Refer to Section 09 91 00 “Painting.”

B. Transparent Finish: Refer to section 09 93 00 “Staining and Transparent Finishing.”

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to average prevailing humidity conditions in installation areas.

B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install interior architectural woodwork level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with interior architectural woodwork.

F. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long except where shorter single-length pieces are necessary.

1. Scarf running joints and stagger in adjacent and related members.
2. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
3. Install standing with no more variation from a straight line than 1/8 inch in 96 inches.

G. Touch up finishing work specified in this Section after installation of interior architectural woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects. Where not possible to repair, replace interior architectural woodwork. Adjust joinery for uniform appearance.

B. Clean interior architectural woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 40 23

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SECTION 06 41 16
PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show full-size details.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
5. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Initial Selection: For each type of exposed finish.

D. Samples for Verification: For the following:

1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.

    a. Provide one sample applied to core material with specified edge material applied to one edge.

2. Thermoset Decorative Panels: 8 by 10 inches, for each color, pattern, and surface finish.

    a. Provide edge banding on one edge.

3. Corner Pieces:

    a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
    b. Miter joints for standing trim.

4. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Certificates: For each type of product.

C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.8 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: Manufacturer of products.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups of typical architectural cabinets as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.10 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.

C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 CABINETS, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of architectural cabinets indicated for construction, finishes, installation, and other requirements.

2.2 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

B. Architectural Woodwork Standards Grade: Custom.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on the Finish Schedule, or comparable product by one of the following:

a. Formica Corporation.
b. Lamin-Art, Inc.
c. Wilsonart LLC.
d. Chemetal.

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade VGS.
4. Edges: Grade HGS.
5. Pattern Direction: Match Mock-up.

G. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.

a. Edges of Plastic-Laminate Shelves: PVC edge banding, 1/8-inch thick, matching laminate in color, pattern, and finish.

2. Drawer Sides and Backs: Solid-hardwood lumber.
3. Drawer Bottoms: Hardwood plywood.

H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from Manufacturers full range.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Softwood Plywood: DOC PS 1, medium-density overlay, provide Marine-Grade at sink bases.

2.4 CABINET CONSTRUCTION

A. Support bases for base cabinets shall be 2-inch x 4-inch minimum pressure treated material. Cabinet Base: 4-inch high, 3/4-inch CDX plywood, marine grade at sink bases. Provide additional center support for cabinets over 24 inches wide.

B. Base, Wall, and Tall Cabinet Boxes

1. Sides, bottom, and top: Constructed of glued and spline doweled 3/4-inch formaldehyde-free plywood providing balanced construction, surfaced with cabinet liner CLS for semi-exposed and vertical grade laminate for exposed locations.
2. Wall cabinet bottoms and tops: Constructed of glued and spline doweled one-inch-thick formaldehyde-free plywood, providing balanced construction surfaced with vertical grade laminate for exposed locations and cabinet liner CLS for semi-exposed locations.
3. Back panel: Constructed of minimum 1/4-inch prefinished tempered hard board, surfaced with CLS for semi-exposed and vertical grade laminate for exposed locations, inset and glued into sides, bottom, and top.
4. Exposed backs: Constructed of 3/4-inch formaldehyde-free plywood, surfaced with vertical grade laminate of balanced construction for semi-exposed locations, glued and spline doweled, and mechanically attached if required.
5. Intermediate support rail: Minimum 3/4-inch formaldehyde-free plywood, surfaced with vertical grade laminate of balanced construction, glued and doweled into cabinet sides.
6. Hanger rails: Two located at top and bottom of cabinet back, 3 on tall cabinets, locate at top, bottom, and center of 3/4 inch formaldehyde-free plywood.

C. Fixed and Adjustable Shelves and Dividers

1. One-inch (formaldehyde-free plywood) shelves
2. Exposed Locations: Vertical grade plastic laminate both sides. Color to match cabinet exterior plastic laminate or as selected by Architect.
3. Semi-exposed locations: VGS or CLS
4. Front and back leading edges shall be edged with flat 1mm thick high impact PVC edging to match shelf color.
5. Number of adjustable shelves provided, unless indicated otherwise on the Drawings or on the Schedule

a. Low and tall cabinets

1)	1 up to 24 inches	4 up to 72 inches
2)	2 up to 36 inches	5 up to 84 inches
3)	3 up to 60 inches	6 up to 96 inches

b. Wall hung cabinets

1)	0 up to 24 inches	2 up to 36 inches
2)	1 up to 30 inches	3 up to 40 inches

6. Adjustable dividers: 1/4-inch minimum thickness, prefinished tempered hardboard or plywood, smooth both faces, retained by molded plastic support clip.
7. Fixed dividers: Constructed of 3/4-inch plywood, surfaced with vertical grade laminate, providing balanced construction; glued and spline doweled. PVC edged to match laminate or adjacent PVC edging.

D. Cabinet Doors

1. 3/4-inch formaldehyde-free particleboard
2. High pressure plastic vertical grade laminate exterior and interior.
3. Doors 48 inches and less in length shall have 2 hinges per door; doors over 48 inches in length shall have 3 hinges per door.
4. Corners: Square with radiused edges, 3mm PVC edging.

E. Counter tops:

1. High Pressure Plastic Laminate: GP-50 grade.
2. Plywood concealed members; solid formaldehyde-free plywood shall be 7 – Ply marine grade boat plywood or Baltic birch marine grade boat plywood.
3. Plywood shall incorporate Type II water resistant glue.
4. Horizontal work surfaces to be 1-1/2 inch thick unless otherwise noted.
5. Cut openings in countertops for sinks or other items required. Cut to size from template furnished by supplier of sinks or use the designated sinks on job.
6. Edging: Radius, with 3mm PVC.
7. Provide balancing sheet on opposite face.
8. Laminate tops shall be continuous in practical lengths. When requiring splice joints, use a combination of splines or dowels for alignment and Tite-Joint fasteners as required to make a uniform and gapless joint.
9. All protruding countertops edges shall be mitered.
10. Backsplash and Endsplashes: Scribable, square set, color matching, and mechanically attached.

    a. Backsplashes are required at locations where countertops abut walls where indicated on Drawings.
    b. Edges of back and endsplashes shall be of square edge configuration.

2.5 CABINET HARDWARE AND ACCESSORIES

A. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges made from 0.095-inch- thick metal, and as follows:

1. Semiconcealed Hinges for Overlay Doors: ANSI/BHMA A156.9, B01521.

B. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.

C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

D. Adjustable Shelf Standards and Supports (Heavy Duty): ANSI/BHMA A156.9, B04102; with shelf brackets, B04112.

E. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.

F. Drawer Slides: ANSI/BHMA A156.9.

1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer.

a. Type: Full extension.
b. Material: Epoxy-coated steel with polymer rollers.

2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-overtravel-extension type; zinc-plated-steel ball-bearing slides.
3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 2.
4. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
6. For computer keyboard shelves, provide Grade 1HD-100.
7. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-200.

G. Door Locks: ANSI/BHMA A156.11, E07121.

H. Drawer Locks: ANSI/BHMA A156.11, E07041.

I. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

J. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: Black.

K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.

L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

M. Book Depository Chute.

1. Basis of Design Product and Manufacturer; American Book Returns Thru Wall Return - Book Drop and Chute. Item No. 83-11753, or approved Equal.

2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.7 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

D. Install glass to comply with applicable requirements in Section 08 80 00 "Glazing" and in GANA's "Glazing Manual."

1. For glass in frames, secure glass with removable stops.
2. For exposed glass edges, polish and grind smooth.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers' fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

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Division 07

Thermal and Moisture Protection

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SECTION 07 11 13
BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cold-applied, emulsified-asphalt dampproofing.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1.4 FIELD CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials.

2.2 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Basis-of-Design Product: Subject to compliance with requirements, provide W. R. Meadows, Inc; Sealmastic or a comparable product by one of the following:

1. Euclid Chemical Company (The); an RPM company.
2. Karnak Corporation.

B. Trowel Coats: ASTM D 1227, Type II, Class 1.

2.3 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

B. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.

C. Patching Compound: Epoxy or latex-modified repair mortar of type recommended in writing by dampproofing manufacturer.

D. Patching Compound: Epoxy or latex-modified repair mortar of type recommended in writing by dampproofing manufacturer.

E. Protection Course for planter: ASTM D6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.

1. Thickness: Nominal 1/4 inch.
2. Adhesive: Rubber-based solvent type recommended in writing by waterproofing manufacturer for protection course type.

2.4 MOLDED-SHEET DRAINAGE PANELS FOR PLANTERS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel acceptable to dampproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core, with or without a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft..

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.

1. Test for surface moisture according to ASTM D 4263.

B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.

C. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.

1. Apply dampproofing to provide continuous plane of protection.
2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.

3.4 INSTALLATION OF PROTECTION COURSE

A. Install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.

1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
2. Install protection course within 24 hours of dampproofing installation (while coating is tacky) to ensure adhesion.

3.5 INSTALLATION OF DRAINAGE PANEL

A. Molded-Sheet Drainage Panels: Install panels, with geotextile facing away from wall substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate dampproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.6 CLEANING

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 11 13

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SECTION 07 13 10
UNDERSLAB SHEET MEMBRANE WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Underslab, membrane waterproofing.

1.3 PERFORMANCE REQUIREMENTS

A. Provide membrane waterproofing that prevents the passage of water.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's standard product data with general and specific installation instructions, recommendations, and limitations from waterproofing materials manufacturer for each required type of waterproofing system.

1. Certification: Include certification by waterproofing materials manufacturer that products supplied complies with local VOC regulations.
2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

B. Samples: Provide samples of sheet membrane waterproofing and auxiliary materials mounted on plywood for Architect's review and approval.

1. Size: Not less than 12 x 12 inches.

C. Certifications:

1. Certification, at time of bid, materials comply with specified performance characteristics and physical requirements specified
2. Certification that waterproofing system and components are provided by a single source supplier
3. Certification, at time of bid, that installer has current Approved Applicator status with waterproofing material manufacturer

D. Pre-Installation Minutes: Submit pre-installation conference meeting minutes.

E. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.

F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience.

1. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.
2. Certification is required from manufacturer that Installer has been trained in the handling and installation of their products.

G. Warranty Data: Sample manufacturer's warranty data and sample certificate for terms and applicable warranty requirements and/or conditions.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Obtain primary waterproofing materials of each type required from a single manufacturer to the greatest extent possible.

1. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Installer: A firm with not less than ten waterproofing projects similar to requirements for this Project with satisfactory in-service performance acceptable to primary waterproofing materials manufacturer.

C. Pre-installation Conference: Before installing waterproofing and associated work, meet at Project site with Installer of each component of associated work, inspection and testing agency representatives (if any), and installers of work requiring coordination with waterproofing work. Also, include the manufacturer's technical representative. Review material selections and procedures to be followed in performing work. Notify Architect and Manufacturer's representative at least 48 hours before conducting meeting.

1. Manufacturer's technical representative shall review installation of sheet membrane waterproofing before placement of concrete. This shall be conducted as part of the warranty requirements.

D. Waterproofing firm (installer) and waterproofing membrane manufacturer shall have a least 10 years successful experience in the type of waterproofing system specified. Waterproofing contractor shall be approved and trained specifically by the sheet membrane manufacturer in the installation of sheet membrane waterproofing.

E. Single Source Responsibility: Waterproofing and associated work shall be performed by a single firm.

F. Waterproofing membrane manufacturer shall provide a qualified technical waterproofing inspector on the job site during installation of the sheet membrane waterproofing. The technical waterproofing inspector shall be present for the pre-installation conference, a minimum of three (3) times per week during the waterproofing membrane and flashing installation, and shall accompany the Architect during the Substantial Completion inspection for the Project.

G. Mock-Up: Provide not less than a 10 ft. x 10 ft. mock-up of the waterproofing required for this Project and comply with the following:

1. Mock-up shall include all flashings and accessories for a watertight mock-up in every respect.
2. Obtain approval by the Architect before proceeding with waterproofing work.
3. Waterproofing manufacturer shall be on-site with the Architect during the review and approval of the mock-up.

    a. If Architect determines mock-ups do not comply with requirements, reapply waterproofing until mock-ups are approved.
    b. Approved mockups shall be protected during construction and, provided that it is undeteriorated, may remain and become part of the completed Work at time of Substantial Completion.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Storage:

1. Store liquid materials in their original, undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
2. Store rolls according to manufacturer's written instructions.
3. Protect and keep stored materials from exposure to direct sunlight.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

1.7 PROJECT CONDITIONS

A. Substrate: Proceed with work after substrate construction, openings, and penetrating work have been completed and areas are free of standing or running water, ice, and frost. Verify that concrete substrate is dry, smooth, and free from sharp or ragged out-angles, honeycombing, rock pockets, depressions, and projections.

B. Weather: Proceed with work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations and warranty requirements.

1.8 WARRANTY

A. Warranty: Executed by the manufacturer, agreeing to repair or replace sheet membrane waterproofing that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 UNDERSLAB MEMBRANE WATERPROOFING

A. Provide the following underslab membrane waterproofing at recessed auditorium and under all wood floor areas:

1. Basis-of-Design Product: Subject to compliance with requirements, provide W.R. Meadows, Inc; Premoulded Membrane Vapor Seal with Plasmatic Core,. or a comparable product by one of the following:

a. Grace Construction Products; W.R. Grace & Co. -- Conn.
a. Polyguard Products, Inc.

B. Mastic, Adhesives, and Detail Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

2.2 AUXILIARY MATERIALS

A. Adhesives and Joint Tape: Provide types of adhesive compound and tapes recommended by waterproofing sheet manufacturer for bonding to substrate (if required), for waterproofing seams in membrane, and for waterproofing joints between membrane and flashings, adjoining surfaces, and projections through membrane.

B. Primers: Provide type of concrete primer recommended by manufacturer of sheet waterproofing material for applications required.

C. Flashing Materials: Except as otherwise indicated, provide types of flexible sheet material for flashing as recommended by waterproofing sheet manufacturer.

D. Protection Board: Provide type of protection board recommended by waterproofing sheet manufacturer. Include adhesives recommended by manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with manufacturer's instructions for preparing surfaces indicated to receive sheet waterproofing.

B. Apply primer to substrate surfaces at rate recommended by manufacturer of primary waterproofing materials.

1. Prime only area that will be covered by waterproofing membrane in same working day.
2. Re-prime areas not covered by waterproofing membrane within 24 hours.

3.2 GENERAL INSTALLATION PROVISIONS

A. Inspect both the substrate and conditions under which Work is to be performed.

1. Do not proceed until unsatisfactory conditions have been corrected.

B. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

3.3 INSTALLATION

A. Comply with manufacturer's instructions for handling and installing sheet waterproofing materials.

B. Coordinate installing waterproofing materials with associated work to provide complete system complying with combined recommendations by manufacturers and installers involved in Work.

1. Schedule installation to minimize exposure of sheet waterproofing materials.

3.4 UNDERSLAB MEMBRANE INSTALLATION

A. Apply membrane in accordance with manufacturer's instructions to provide a permanent, monolithic vapor seal without voids or open seams.

B. Ensure accessory materials are compatible with membrane and approved by membrane manufacturer.

C. Place membrane in position by either Dutch lap method with laps sealed with bonding asphalt or by butt joint method with joints sealed with joint tape.

D. Point exposed edges with pointing mastic to prevent water from traveling under membrane.

E. Place membrane collar around protrusions through concrete slab, including sewer pipes, water pipes, and utility inlets to create a positive seal between protrusions and membrane. Seal in place with joint tape and point around protrusions with pointing mastic.

F. Adhere membrane to vertical surfaces with adhesive.

G. Install underslab membrane waterproofing in strict accordance with the manufacturer’s written installation instructions.

1. Coordinate extents of underslab membrane where wood floors are adjacent to other types of flooring.

H. Provide all items and accessories as required for a complete installation in every respect.

3.5 FIELD QUALITY CONTROL

A. In-Place Testing: Before completed membranes on horizontal surfaces are covered by protection course or other work, test for leaks with a 1-inch depth of water maintained over the high point for 24 hours.

1. Repair all leaks observed; repeat test and repairs until no leaks remain in work.

3.6 CLEANING AND PROTECTION

A. After completion, remove any masking materials and stains from exposed surfaces caused by waterproofing installation.

B. Protect waterproofing membrane in strict accordance with manufacturer's written recommendations to ensure that work is undamaged at Date of Substantial Completion.

1. Protect completed membrane during installation of other materials or processes over membrane until concrete is placed or vertical surfaces are backfilled.
2. Do not allow unnecessary traffic of any type on unprotected membrane.

END OF SECTION 07 13 10

SECTION 07 13 13
SHEET MEMBRANE WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Self-adhering membrane waterproofing.

1.3 PERFORMANCE REQUIREMENTS

A. Provide membrane waterproofing that prevents the passage of water.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's standard product data with general and specific installation instructions, recommendations, and limitations from waterproofing materials manufacturer for each required type of waterproofing system.

1. Certification: Include certification by waterproofing materials manufacturer that products supplied complies with local VOC regulations.
2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

B. Samples: Provide samples of sheet membrane waterproofing and auxiliary materials mounted on plywood for Architect's review and approval.

1. Size: Not less than 12 x 12 inches.

C. Certifications:

1. Certification, at time of bid, materials comply with specified performance characteristics and physical requirements specified
2. Certification that waterproofing system and components are provided by a single source supplier
3. Certification, at time of bid, that installer has current Approved Applicator status with waterproofing material manufacturer

D. Pre-Installation Minutes: Submit pre-installation conference meeting minutes.

E. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.

F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience.

1. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.
2. Certification is required from manufacturer that Installer has been trained in the handling and installation of their products.

G. Warranty Data: Sample manufacturer's warranty data and sample certificate for terms and applicable warranty requirements and/or conditions.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Obtain primary waterproofing materials of each type required from a single manufacturer to the greatest extent possible.

1. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Installer: A firm with not less than ten waterproofing projects similar to requirements for this Project with satisfactory in-service performance acceptable to primary waterproofing materials manufacturer.

C. Pre-installation Conference: Before installing waterproofing and associated work, meet at Project site with Installer of each component of associated work, inspection and testing agency representatives (if any), and installers of work requiring coordination with waterproofing work. Also, include the manufacturer's technical representative. Review material selections and procedures to be followed in performing work. Notify Architect and Manufacturer's representative at least 48 hours before conducting meeting.

1. Manufacturer's technical representative shall review installation of sheet membrane waterproofing before placement of concrete. This shall be conducted as part of the warranty requirements.

D. Waterproofing firm (installer) and waterproofing membrane manufacturer shall have a least 10 years successful experience in the type of waterproofing system specified. Waterproofing contractor shall be approved and trained specifically by the sheet membrane manufacturer in the installation of sheet membrane waterproofing.

E. Single Source Responsibility: Waterproofing and associated work shall be performed by a single firm.

F. Waterproofing membrane manufacturer shall provide a qualified technical waterproofing inspector on the job site during installation of the sheet membrane waterproofing. The technical waterproofing inspector shall be present for the pre-installation conference, a minimum of three (3) times per week during the waterproofing membrane and flashing installation, and shall accompany the Architect during the Substantial Completion inspection for the Project.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Storage:

1. Store liquid materials in their original, undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
2. Store rolls according to manufacturer's written instructions.
3. Protect and keep stored materials from exposure to direct sunlight.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

1.7 PROJECT CONDITIONS

A. Substrate: Proceed with work after substrate construction, openings, and penetrating work have been completed and areas are free of standing or running water, ice, and frost. Verify that concrete substrate is dry, smooth, and free from sharp or ragged out-angles, honeycombing, rock pockets, depressions, and projections.

B. Weather: Proceed with work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations and warranty requirements.

1.8 WARRANTY

A. Warranty: Executed by the manufacturer, agreeing to repair or replace sheet membrane waterproofing that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Grace Construction Products; W.R. Grace & Co. -- Conn.; Bituthene 3000 or a comparable product by one of the following:

    a. Carlisle Coatings & Waterproofing Inc.
    a. Polyguard Products, Inc.
    a. W. R. Meadows, Inc.

2.2 AUXILIARY MATERIALS

A. Adhesives and Joint Tape: Provide types of adhesive compound and tapes recommended by waterproofing sheet manufacturer for bonding to substrate (if required), for waterproofing seams in membrane, and for waterproofing joints between membrane and flashings, adjoining surfaces, and projections through membrane.

B. Primers: Provide type of concrete primer recommended by manufacturer of sheet waterproofing material for applications required.

C. Flashing Materials: Except as otherwise indicated, provide types of flexible sheet material for flashing as recommended by waterproofing sheet manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with manufacturer's instructions for preparing surfaces indicated to receive sheet waterproofing.

B. Apply primer to substrate surfaces at rate recommended by manufacturer of primary waterproofing materials.

1. Prime only area that will be covered by waterproofing membrane in same working day.
2. Re-prime areas not covered by waterproofing membrane within 24 hours.

3.2 GENERAL INSTALLATION PROVISIONS

A. Inspect both the substrate and conditions under which Work is to be performed.

1. Do not proceed until unsatisfactory conditions have been corrected.

B. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

3.3 INSTALLATION

A. Comply with manufacturer's instructions for handling and installing sheet waterproofing materials.

B. Coordinate installing waterproofing materials with associated work to provide complete system complying with combined recommendations by manufacturers and installers involved in Work.

1. Schedule installation to minimize exposure of sheet waterproofing materials.

3.4 CLEANING AND PROTECTION

A. After completion, remove any masking materials and stains from exposed surfaces caused by waterproofing installation.

B. Protect waterproofing membrane in strict accordance with manufacturer’s written recommendations to ensure that work is undamaged at Date of Substantial Completion.

1. Protect completed membrane during installation of other materials or processes over membrane until concrete is placed or vertical surfaces are backfilled.
2. Do not allow unnecessary traffic of any type on unprotected membrane.

END OF SECTION 07 13 13

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SECTION 07 17 00
BENTONITE WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bentonite waterproofing.

1.3 SUBMITTALS

A. Product Data: Include product specifications, installation instructions and recommendations of manufacturer, for each material and type of application required.

B. Shop Drawings: Show installation details for interface with other work.

C. Contractor Certificate: Submit written certification that installer has current Approved Applicator status with waterproofing material manufacturer.

D. Warranty: Submit a specimen of specified waterproofing warranty.

E. Test Report: Submit manufacturer's test report on water samples taken at the site along with recommendations as a result of these tests.

F. Field quality-control reports.

G. Manufacturer Certificates: Signed by materials manufacturer certifying that waterproofing system complies with requirements specified.

H. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installing company shall have at least three years' experience in work of the type indicated, who can comply with manufacturer's warranty requirements, and who is an Approved Applicator as determined by waterproofing system manufacturer.

B. Single-Source Responsibility: Obtain bentonite waterproofing system from one source of a single manufacturer. Obtain accessory products used in conjunction with bentonite waterproofing from sources acceptable to the bentonite waterproofing manufacturer.

C. Preinstallation Conference: Approximately 2 weeks prior to scheduled commencement of waterproofing installation, meet at Project site with Waterproofing Installer; preparer of substrate to receive waterproofing; installers of other work in and around waterproofing that must precede, follow, or penetrate waterproofing (including Mechanical and Electrical Installers as applicable); Architect; Owner; and waterproofing manufacturer's representative to review materials, procedures, schedules, and other requirements and conditions related to installing bentonite waterproofing.

D. Water Samples: Obtain water samples from the site at approximate locations where waterproofing will be installed and have the waterproofing manufacturer test for acids, alkalis, brine, or other contaminants that may inhibit the performance of untreated bentonite. Comply with manufacturer's recommendations resulting from these tests.

E. Manufacturer Certificates: Signed by waterproofing system materials manufacturer certifying that the installation complies with requirements specified.

1. Submit evidence of meeting performance requirements.
2. Manufacturer shall attend pre-construction meetings, and shall conduct site visits during construction and after completion of construction (for that phase of work that directly applies to the specific product) before issuing a manufacturer warrantee certificate.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original unopened containers.

B. Store materials in a dry, well-ventilated space and in accordance with manufacturer’s instructions and recommendations.

C. Remove and replace bentonite materials that have been prematurely exposed to moisture.

1.6 PROJECT CONDITIONS

A. General: Comply with manufacturer's recommendations regarding weather conditions before and during installation, condition of the substrate to receive waterproofing, and protection of the installed waterproofing system.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit bentonite waterproofing to be installed according to manufacturers' written instructions and warranty requirements.

1. Do not apply waterproofing materials to surfaces where ice or frost is visible. Do not apply bentonite waterproofing materials in areas with standing water.
2. Placing bentonite clay products in panel or composite form on damp surfaces is allowed if approved in writing by manufacturer.

1.7 WARRANTY

A. Manufacturer’s Warranty: Submit manufacturer's Warranty in which manufacturer agrees to provide waterproofing system materials to repair or replace components of bentonite waterproofing system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Installer's Warranty: Submit installer's Warranty in which installer agrees to provide all labor required to repair or replace components of bentonite waterproofing system that fail within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bentonite Waterproofing – Under Concrete Slabs and Foundations:

1. Product and Manufacturer – Basis of Design: Ultraseal AB; CETCO, Colloid Environmental Technologies Company.

B. Bentonite Waterproofing – Vertical Walls Below Grade:

1. Product and Manufacturer – Basis of Design: Ultraseal AB; CETCO, Colloid Environmental Technologies Company.

2.2 ACCESSORIES

A. General: Provide accessories as recommended by manufacturer for a complete and waterproof system. Accessories include, but are not limited to, the following:

1. Bentonite Seal (Mastic): Trowelable consistency, bentonite compound, specifically formulated for application at joints and penetrations.

a. Product: Bentoseal.

2. Termination Bar: Minimum 1-inch wide aluminum bar with pre-punched holes on 12-inch centering for fastening.

a. Fasteners for Termination Bar: 300 Series stainless steel.

3. Seam Tape: Type recommended by the materials manufacturer for applications indicated.

4. Transition Tube: Granular bentonite clay (sodium bentonite), minimum 85 percent montmorillonite (hydrated aluminum silicate), with a minimum of 90 percent passing a 20-mesh sieve.

a. Product: Hydrobar Tubes; water-soluble plastic tubing filled with bentonite.

5. Mechanical Fasteners: Case hardened nails or hardened-steel powder-actuated fasteners. Provide 1/2-inch diameter or 1-inch diameter washers (dependant on manufacturer's requirements) under fastener heads.
6. Waterstoppage: Dry granular bentonite.

7. Preformed Waterstop: Flexible strip of bentonite waterproofing compound in cartridge or coil form, designed specifically for vertical and horizontal joints in concrete construction.

    a. Product: Waterstop Rx.

8. Plastic Sheets: Polyethylene sheeting conforming to ASTM D 4397, thickness as recommended by waterproofing manufacturer to suit application, but not less than 15.0 mils.
9. Sealants: As recommended by manufacturer. Comply with requirements specified in Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer, manufacturer's representative, and Owner's Representative present, for compliance with requirements for substrate preparations affecting performance of bentonite waterproofing.

B. Verify that substrate is complete and that work that will penetrate waterproofing is complete and rigidly installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Provide photo documentation.

3.2 PREPARATION

A. General: Comply with manufacturer's instructions and recommendations. Verify that substrate is complete and that all work that will penetrate waterproofing is complete and rigidly installed. Verify locations of waterproofing termination.

1. Coordinate work in vicinity of waterproofing to assure proper conditions for installation of the waterproofing system and to prevent damage to the waterproofing after installation.

3.3 INSTALLATION

A. General: Install waterproofing and accessories according to manufacturer's instructions, standard details, and recommended practices.

1. Protect waterproofing from damage and wetting before and during subsequent construction operations. Repair punctures, tears, and cuts according to manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Inspection: Arrange for manufacturer's representative and Owner's Representative to inspect during installation and completed waterproofing installation before covering with other construction and provide written report that installation complies with manufacturer's written instructions.

1. Remove and replace applications of bentonite waterproofing where inspection indicates that it does not comply with specified requirements.
2. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

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SECTION 07 18 13
PEDESTRIAN TRAFFIC COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes traffic coatings for the following applications:

1. Pedestrian traffic.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Approval: Submit current Product Approval documentation in accordance with the Florida Building Code.

B. Product Data: For each type of product.

1. Include installation instructions and details, material descriptions, dry or wet film thickness requirements, and finish.

C. Shop Drawings: For traffic coatings.

1. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions that are not included in manufacturer's product data.

D. Samples for Initial Selection: For each type of exposed finish.

E. Samples for Verification: For each type of exposed finish, prepared on rigid backing.

1. Provide stepped Samples on backing to illustrate buildup of traffic coatings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of traffic coating.

C. Field quality-control reports.

D. Sample Warranty: For manufacturer's warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For traffic coatings to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Acceptable Contractor: Contractor shall be certified in writing by the waterproofing materials manufacturer to install the primary waterproofing products.

B. Product Quality Assurance Program: Primary waterproofing materials shall be manufactured under a quality management system that is monitored regularly by a third party auditor under the ISO 9001 audit process.

C. Project Acceptance: Submit a completed manufacturer's application for waterproofing guarantee form along with shop drawings of areas to receive waterproofing, showing all dimensions, penetrations, and details. The form shall contain all the technical information applicable to the project. The project must receive approval by the membrane manufacturer, through this process, prior to shipment of materials to the project site.

D. Scope of Work: The work to be performed under this specification section shall include, but is not limited to, the following: Attend necessary job meetings and furnish competent and full time supervision, experienced mechanics, all materials, tools, and equipment necessary to complete, in an acceptable manner, the waterproofing system installation in accordance with this specification. Comply with the latest written application instructions of the manufacturer of the specific waterproofing products.

E. Local Regulations: Conform to regulations of public agencies, including any specific requirements of the city and/or state of jurisdiction.

F. Manufacturer Requirements: The primary materials manufacturer shall provide trained company personnel to attend necessary job meetings, perform periodic inspections as necessary, and conduct a final inspection upon successful completion of the project.

1.8 PRODUCT DELIVERY STORAGE AND HANDLING

A. Delivery: Deliver materials in the manufacturer's original sealed and labeled containers and in quantities required to allow continuity of application.

B. Storage: Store closed containers in a cool, dry, well ventilated area away from heat, direct sunlight, oxidizing agents, strong acids, and strong alkalis. Keep products away from open fire, flame or any ignition source. Store temperature sensitive products at temperatures recommended by the manufacturer. Quartz silica (sand) must be kept dry during storage and handling.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.

1. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.

B. Do not install traffic coating until items that penetrate membrane have been installed.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace traffic coating that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Adhesive or cohesive failures.
b. Abrasion or tearing failures.
c. Surface crazing or spalling.
d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.

2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations:

1. Obtain traffic coatings from single source from single manufacturer.
2. Obtain primary traffic-coating materials, including primers, from traffic-coating manufacturer. Obtain accessory materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of types and from sources recommended in writing by primary material manufacturer.
3. Obtain pavement-marking paint from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Material Compatibility: Provide primers; base coat, intermediate coat, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.3 TRAFFIC COATING

A. Traffic Coating: Manufacturer's standard, traffic-bearing, seamless, high-solids-content, cold liquid-applied, elastomeric, water-resistant membrane system with integral wearing surface for pedestrian traffic; according to ASTM C 957/C 957M.

B. Liquid-Applied Pedestrian Traffic Waterproofing System: A reinforced fluid-applied, PMMA-based waterproofing system having a natural quartz texture and a color finish/acrylic chip surfacing selected from the manufacturer's standard palette of colors.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Terapro Reinforced Pedestrian Traffic Waterproofing System by Siplast, Inc.; or a comparable product by one of the following:

a. Key Resin Company.
b. Neogard; a division of Jones-Blair, Inc.
c. Tremco Incorporated.

2. Color: As selected by Architect from Manuafcturers full range.

2.4 MATERIALS

A. Membrane/Flashing Waterproofing Materials

B. Manufacturers recommended products for the following application:

1. Primer for use over horizontal concrete substrates.
2. Flashing Resin for use in combination with a fleece fabric to form a monolithic, reinforced flashing membrane used in conjunction with a reinforced waterproofing system.
3. Base Resin: Flexible, for use as waterproofing in a reinforced waterproofing system.
4. Fleece: A non-woven, needle-punched polyester fabric used as a reinforcement.

a. Nominal Thickness: 40 mils
b. Weight: 110 grams per square meter

5. Waterproofing/Wearing Layer Resin: Aggregate based.
6. Aggregate Filler for Waterproofing/Wearing Layer Resin: Quartz aggregate blend/filler added to the waterproofing/wearing layer resin.
7. Color Finish: A pigmented, multi-component, resin for use as both an embedment and finish layer in waterproofing and flashing systems.

2.5 WATERPROOFING ACCESSORIES

A. As recommended by the manufacturer for installation:

1. Cleaning Solution/Solvent: Clear solvent used to clean and prepare transition areas of in-place catalyzed resin to receive subsequent coats of resin and to clean substrate materials to receive resin.
2. Paste: Manufacturers recommended paste used for remediation of depressions in substrate surfaces prior to the application of the waterproofing system.
3. Repair Mortar: A two-component, aggregate filled mortar used for patching concrete substrates.

4. Catalyst: A peroxide-based reactive agent used to induce curing of resins.
5. Natural Quartz: A natural-colored, kiln-dried, silica aggregate suitable for broadcast into the wearing layer of the waterproofing system to generate a skid resistant surface. Quartz shall be supplied by the manufacturer of the waterproofing membrane.
6. Chip Surfacing Blend: A blend of flat, angular, pigmented polymer flakes broadcast into the color finish layer of the waterproofing system. The chip blend shall be supplied by the manufacturer of the waterproofing membrane.
7. Additive; Manufacturers recommended additive where necessary for increasing the viscosity of the resin based products, allowing the resins to be applied over vertical or sloped substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, surface smoothness, and other conditions affecting performance of traffic-coating work.

B. Moisture Content Evaluation: Evaluate the level of moisture in the substrate to determine that the moisture content is acceptable for application of the specified waterproofing system. Concrete substrates shall have a maximum moisture content of 6% by weight and a maximum internal relative humidity of 75%.

1. Test for moisture according to ASTM D 4263.
2. Test for moisture content by method recommended in writing by traffic-coating manufacturer.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of traffic-coating work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Begin coating application only after substrate construction and penetrating work have been completed.
2. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.
3. Application of coating indicates acceptance of surfaces and conditions.

E. Adhesion Testing for Concrete Substrates to Receive Resin Materials: Test the concrete substrate using a device conforming to ASTM D 4541 adhered with the specified catalyzed primer. Utilize the same concrete preparation methods as that which will be used prior to application of the waterproofing for areas to be evaluated for adhesion. Ensure that a minimum adhesion value of 220 psi is obtained before application of the PMMA-based primer. If multiple areas or substrates are involved in the scope of work, evaluate each to determine suitability. Maintain testing/evaluation records.

3.2 SURFACE PREPARATION

A. Preparation of Newly Placed Concrete Substrates to Receive Resin Materials: Newly placed concrete shall be cured a minimum of 28 days in accordance with ACI-308, and have a minimum compressive strength of 3,500 psi (24 N/mm^2). Following evaluation for moisture content and confirmation that the moisture content is at a acceptable level, shot-blast or scarify/shot blast the surface to provide a sound substrate free from laitance and to generate a concrete surface profile of CSP-2 to CSP-4 as defined by the ICRI. Grinding may be used as a preparation method for localized areas that cannot be reached by a shot blasting equipment provided that a surface profile of CSP-2 to CSP 4 can be generated. Repair spalls and voids on vertical or horizontal surfaces using the specified primer and preparation paste.

B. Clean and prepare substrates according to ASTM C 1127 and manufacturer's written instructions to produce clean, dust-free, dry substrate for traffic-coating application. Remove projections, fill voids, and seal joints if any, as recommended in writing by traffic-coating manufacturer.

C. Repair and Leveling of Concrete to Receive Resin Materials: Before application of the waterproofing membrane, and after priming, fill all joints, cracks, voids, fractures, depressions, small indentations, and low areas in the substrate using the specified paste or repair mortar.

D. Crack Preparation: Follow manufacturer’s details for crack preparation prior to waterproofing system application.

E. Shot-blast or grind concrete or masonry wall surfaces to provide a sound substrate free from laitance and all residue from bitumen, coal tar, primer, coatings, adhesives, sealer or any material that may inhibit adhesion of the primer. Following application of the specified primer, but prior to application of the waterproofing system, fill cracks, voids, fractures, depressions, small indentations, and low areas in the substrate using the specified paste. The use of paste or sealant is not an acceptable alternative to repointing mortar joints. Do not apply waterproofing materials over soft or scaling brick or masonry, faulty mortar joints, or walls with broken, damaged or leaking coping components.

F. Priming: Unless manufacturer recommends in writing against priming, prime substrates according to manufacturer's written instructions.

1. Limit priming to areas that will be covered by traffic-coating material on same day. Reprime areas exposed for more time than recommended by manufacturer.

G. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.

H. Mask adjoining surfaces not receiving traffic coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent traffic-coating materials from entering deck substrate penetrations and clogging weep holes and drains.

I. Concrete Substrates: Mechanically abrade surface to a uniform profile acceptable to manufacturer, according to ASTM D 4259. Do not acid etch.

1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
2. Remove concrete fins, ridges, and other projections.
3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.

4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.

3.3 TERMINATIONS AND PENETRATIONS

A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C 1127 and manufacturer's written instructions.

B. Provide sealant cants at penetrations and at reinforced and nonreinforced, deck-to-wall butt joints.

C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.

D. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.

3.4 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C 1127 and manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Comply with recommendations in ASTM C 1193 for joint-sealant installation.

B. Apply reinforcing strip in traffic-coating system where recommended in writing by traffic-coating manufacturer.

3.5 TRAFFIC-COATING APPLICATION

A. Apply traffic coating according to ASTM C 1127 and manufacturer's written instructions.

B. Apply coats of specified compositions for each type of traffic coating at locations as indicated on Drawings.

C. Start traffic-coating application in presence of manufacturer's technical representative.

D. Verify that wet-film thickness of each coat complies with requirements.

E. Uniformly broadcast and embed aggregate in each coat indicated to receive aggregate according to manufacturer's written instructions. After coat dries, sweep away excess aggregate.

F. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated; omit aggregate on vertical surfaces.

G. Cure traffic coatings. Prevent contamination and damage during coating application and curing.

3.6 FIELD QUALITY CONTROL

A. Final Traffic-Coating Inspection: Arrange for traffic-coating manufacturer's technical personnel to inspect membrane installation on completion.

1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

B. Waterproofing will be considered defective if it does not pass inspections.

C. Prepare inspection reports.

3.7 PROTECTING AND CLEANING

A. Protect traffic coatings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 18 13

SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Miscellaneous stuffing insulation
2. Unfaced batt insulation
3. Semi-Rigid Fiberglass insulation.
4. Sound attenuation blankets

1.3 SUBMITTALS

A. Product Data: Each type of insulation product specified.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated on Drawings or specified elsewhere in this Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thickness, widths, and lengths.

2.2 MISCELLANEOUS STUFFING INSULATION

A. Shall be inorganic (non-asbestos) mineral wool insulation without facing, for the purpose of filling and stuffing openings in walls around pipes, structural components, conduits, expansion joints to eliminate noise transfer and to insulate. Use to seal top of interior walls, not fire rated walls, between masonry and roof deck, or as otherwise indicated. Use at expansion joints as detailed or as otherwise indicated. Insulation shall have a flame spread rating of 15 or less, and a smoke development rating of 0; per ASTM E84. Miscellaneous stuffing insulation shall be formaldehyde-free. Approved manufacturers are as follows:

1. Thermafiber Corporation
2. Rock Wool Manufacturing Company

2.3 UNFACED BATT INSULATION

A. Unfaced preformed glass fiber batt insulation conforming to ASTM C665, Type I. Flame spread shall be 25, smoke developed 50 in accordance with ASTM E136. Unfaced batt insulation shall be formaldehyde-free. Approved manufacturers are as follows:

1. Owens-Corning Fiberglas Corp.
2. Knauf Fiber Glass
3. CertainTeed Corporation
4. JohnsManville

2.4 SEMI RIGID FIBERGLASS INSULATION

A. Glass-Fiber Board, Unfaced: ASTM C 612, Type IA; unfaced, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84, passing ASTM E 136 for combustion characteristics. Nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville; a Berkshire Hathaway company; Fiberglass 703 or Johns Manville, IS300, 1-1/2-inch thick or a comparable product by one of the following:

1. CertainTeed Corporation.
2. Knauf Insulation.
3. Owens Corning.

2.5 SOUND ATTENUATION BLANKETS

A. Sound Attenuation Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool, with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

1. Owens-Corning Fiberglas Corp.
2. Knauf Fiber Glass;
3. CertainTeed Corporation;
4. JohnsManville.

2.6 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Owens Corning, Insul-Quick system or a comparable product by one of the following:

1. AGM Industries, Inc
2. Gemco.

C. The rigid fiberglass insulation shall be installed using welded pins or studs finished with sheet metal pins utilizing the Fiberglas “Insul-Quick” system with speed washers or studs. Nuts shall be installed 12” x 18” centers and the insulation impaled over them. The sheet metal shall be secured to the same fasteners. Seal all joints with sealant or tape as recommended by the manufacturer.

D. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

E. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

3.4 MISCELLANEOUS STUFFING INSULATION

A. Where the Drawings call for interior walls to extend to deck or roof, openings in walls between rooms above the ceiling shall be sealed with mineral wool placed or stuffed in openings to eliminate noise transfer and air movement. Mineral wool insulation shall be provided at other building locations indicated or requiring minor fill to eliminate air movement.

B. Also use mineral wool stuffing at the transition between semi-rigid insulations where the GWB ends within the interstitial space above the ceiling on exterior tilt wall applications

3.5 BATT INSULATIONS

A. Install in areas as indicated. Install in strict accordance with the manufacturers written installation instructions. Install in all exterior wall voids, behind beams, and concealed locations in the exterior walls and roof areas of the building whether or not indicated. All gaps shall be filled with batt insulation.

B. Install thermal insulation as follows:

1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw attach short flange of furring channel to web of attached channel. Start from this furring channel with standard width insulation panel and continue in regular manner. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
4. Until gypsum board is installed, hold insulation in place with 10-inch staples fabricated from 0.0625-inch (16-gage)-diameter tie wire and inserted through slot in web of member.

C. All voids in the perimeter of the building shell shall be filled and closed with batt insulation or miscellaneous mineral wool stuffing insulation, whether or not indicated or shown. This includes behind all steel beams, wide flange beams, channels, CMU, miscellaneous framing, etc.

3.6 SOUND ATTENUATION BLANKETS

A. Install in interior walls where indicated. Install with clips as recommended by the manufacturer. Install in strict accordance with the manufacturers written installation instructions. Install from floor to full height of wall, or as otherwise indicated.

END OF SECTION 07 21 00

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SECTION 07 21 19
FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Masonry insulation; foamed-in-place insulation.

1.3 SUBMITTALS

A. Product Data: Submit product data for insulation specified.

B. Test Reports: Submit product test reports from and based on tests performed by a qualified independent testing agency evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, and other properties, based on comprehensive testing of current products.

1.4 QUALITY ASSURANCE

A. Manufacturing Standards: Provide insulation from a single approved source. Product components shall be of the same brand from the same approved source arriving at the site either pre-mixed according to the manufacturer’s printed instructions or in unopened factory sealed containers.

B. Installer Qualifications for Foamed-In-Place Masonry Insulation: Engage an authorized contract installer who has been trained and authorized by the product manufacturer.

C. At the Architect’s request, the Installer will provide infrared scanned images of the work prepared by a “Block Wall Scan IR” trained IR technician to confirm that empty core cells are filled with foam insulation. Insulation voids shall be foamed at no added cost to the Owner.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Comply with manufacturer's written instructions for handling and protecting during installation.

1.6 WARRANTY

A. Warranty: Provide a one-year product and installation warranty by the manufacturer and installer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Injected Foam Insulation - Foamed-In-Place Insulation: Two-component, nitrogen-based, non-toxic amino-plast resin, utilizing a foaming catalyst, and air as a delivery method.

1. Product and Manufacturer – Basis of Design: Core-Fill 500; Tailored Chemical Products of Florida, Inc; subject to compliance with requirements, other acceptable Manufacturers offering products which may be incorporated in the Work include the following:

   a. Applegate R-Foam, LLC.
   b. CFI Foam, Inc.
   c. RetroFoam LLC.

2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

3. Fire-Resistance Ratings: Foam shall neither add to nor detract from fire-resistance ratings of insulated fire-resistance rated CMU walls per prevailing building codes.
4. Surface Burning Characteristics: Class A per ASTM E84; Flame Spread Index < 25; Smoke Developed.
5. Index < 450.
6. Thermal Resistance: R-4.6/inch @ 75ºF per either ASTM C518 or ASTM C177.
7. Potential Heat: < 8000 Btu/lb when tested per NFPA 259.EXECUTION

2.2 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

2.3 INSTALLATION

A. General: Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install foamed-in-place insulation from interior, or as specified, prior to installation of interior finish work and after all masonry and structural concrete work is in place; comply with manufacturer's instructions.

C. Fill all open cells and voids in hollow concrete masonry walls where shown on the drawings. The foam insulation shall be pressure injected through a series of 5/8” to 7/8" diameter holes drilled to access each column of block cells e.g. 8" o/c beginning approximately four (4) feet above the finished floor. Repeat this procedure at 10’ to 14’ intervals above the first horizontal row of holes and as needed until the empty core cells are completely filled.

END OF SECTION 07 21 19

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SECTION 07 24 11
EXTERIOR FINISH SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Exterior finish system for soffits where indicated on the Drawings.

1.3 ACTION SUBMITTALS

A. Product Data: For each component, trim, and accessory.

B. Shop Drawings:

1. Include plans, sections, details of components, details of penetrations and terminations, flashing details, joint locations and configurations, and connections and attachments to other work.

C. Samples: For each exposed product and for each color and texture specified, 12 inches square in size.

D. Samples for Initial Selection: For each type of finish-coat color and texture indicated.

1. Include similar Samples of exposed accessories involving color selection.

E. Samples for Verification: 12-inch-square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work including.

1. Include exposed trim and accessory Samples to verify color selected.
2. Include a typical control joint filled with sealant of color selected, as specified in Section 07 92 00 "Joint Sealants."

F. Maintenance Data: For EFS to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An installer certified in writing by manufacturer as qualified to install manufacturer's system using trained workers.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1.6 FIELD CONDITIONS

A. Weather Limitations: Maintain ambient temperatures above 40 deg F for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1.7 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace finish that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Bond integrity and weathertightness.
b. Deterioration of finishes beyond normal weathering.

2. Warranty coverage includes:

a. EFS finish, including base and finish coats and reinforcing mesh.
b. Accessories, including trim components and flashing.

3. Warranty Period: Five years from date of Substantial Completion.

B. Installer’s Warranty: Warrant the system to be free from defects in workmanship for a period of five (5) years from the Date of Substantial Completion issued for the project or this portion of the project.

1. Warranty shall provide 100% labor and material to replace system shown to have defects in workmanship.

PART 2 - PRODUCTS

A. Finish-Coat Materials: Manufacturer's standard acrylic-based coating complying with the following:

1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.

2.2 MANUFACTURER

A. Basis of design Manufacturer; Sto Corp.

B. Other acceptable manufacturers that may be incorporated into the work are but not limited to the following:

1. Dryvit systems.
2. Other acceptable Manufacturers.

C. Soffit Applications

1. Ground Coat for Soffit Applications (STO BTS Plus): A one-component, polymer modified, cementitous, high-build base coat with less than 33 percent portland cement content by weight.
2. Fabric for Soffit Applications: STO mesh, nominal 4.5 ounce per square yard, symmetrical, interlaced open weave glass fiber fabric made with minimu 25 percent by weight alkaline resistant coating for compatibility with Sto materials
3. Finish for soffit applications: STO exterior ready mixed coatings, as manufactured by STO Industries.

    a. Stolit 1.0, ready mixed, acrylic based coating. Abrasion resistant, vapor permeable, water based, flexible, and weather resistant to freeze/thaw cycles, wind driven rain and U.V. light.
    b. Color Selection: The lightness value of the exterior finish color to be applied over Dens-Glass Gold sheathing shall be 20 percent or greater, and the color fastness shall not be less than 7.

4. Colors: Match Architect's sample.
5. Textures: Match Architect's sample.

D. Water: Potable.

E. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784 and ASTM C 1063.

1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
3. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.

2.3 MIXING

A. Comply with manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by manufacturer. Mix materials in clean containers. Use materials within time period specified by manufacturer or discard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Begin coating application only after surfaces are dry.
2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Prepare and clean substrates to comply with manufacturer's written instructions to obtain optimum bond between substrate and FINISH.

3.3 TRIM INSTALLATION

A. Trim: Apply trim accessories at perimeter, expansion joints, and elsewhere as indicated. Coordinate with installation of insulation.

1. Expansion Joint: Use where indicated on Drawings.
2. Casing Bead: Use at other locations.

3.4 BASE-COAT INSTALLATION

A. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.

3.5 FINISH-COAT INSTALLATION

A. Primer: Apply over dry base coat according to EFS manufacturer's written instructions.

B. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

1. Embed aggregate in finish coat according to manufacturer's written instructions to produce a uniform applied-aggregate finish of color and texture matching approved sample.

3.6 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EFS coatings.

END OF SECTION 07 24 11

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SECTION 07 26 10
UNDERSLAB VAPOR RETARDER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide the Work required to provide and install the underslab vapor barrier and its accessories as indicated on the Drawings and as specified herein.

1.3 SUBMITTALS

A. Submit in accordance with Division 01 requirements.

B. Product data and general recommendations from materials manufacturer for types of underslab vapor barrier required.

C. Samples of underslab vapor barrier and auxiliary materials.

D. Submit pre-installation conference meeting minutes.

1.4 QUALITY ASSURANCE

A. Pre-installation Conference: Prior to installing vapor barrier and associated work, meet at Project site with the contractor. Review material selections and procedures to be followed in performing work. Notify Architect at least 48 hours before conducting meeting.

B. Definition: Vapor Barrier: A material or assembly of materials that resists water vapor transmission through it.

C. Vapor Barrier shall comply with:

1. ASTM E 1745, latest edition, “Water Vapor Barriers Used in Contact with Soil or Granular Fill under Concrete Slabs.”
2. ASTM E 1643, latest edition, “Installation of Water Vapor Barriers Used in Contact with Earth or Granular Fill Under Concrete Slabs.”
3. Federal Specification UU-B-790a Type 1, Grade A, Style 4.

1.5 PROJECT CONDITIONS

A. Substrate: Proceed with work after substrate construction, openings, and penetrating work have been completed and areas are free of standing or running water, ice, and frost.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: “Moistop Ultra 15 Underslab Vaper Barrier” as manufactured by Fortifiber Building Products Systems. Products of the following manufacturers are also acceptable provided compliance with requirements as specified herein:

1. Griffolyn Division of Reef Industries, Inc.
2. Stego Industries, LLC.

2.2 UNDERSLAB VAPOR BARRIER

A. Multi-layer composite polyethylene reinforced with fiberglass reinforcing.

B. Class A material in accordance with ASTM E 1745, latest edition.

C. Water Vapor Permeance: 0.02 perms (premium), ASTM F-1249/ASTM E-96.

D. Tensile Strength: 70 lbf/in.

E. Puncture Resistance: 3000 grams (premium) ASTM D-1709.

F. Thickness: 15 mil reinforced.

2.3 AUXILIARY MATERIALS

A. Joint Tape: Provide types of adhesive compound and tapes recommended by underslab vapor barrier manufacturer for seams in vapor barrier, and for projections through vapor barrier.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that all items that pass through the vapor barrier are properly and rigidly installed.

B. Substrate shall be free of projections and irregularities.

3.2 INSTALLATION

A. Comply with manufacturer's instructions for handling and installing underslab vapor barrier materials.

B. Seal projections through vapor barrier and seal seams. Bond to vertical surfaces and also, where shown or recommended by manufacturer, bond to horizontal surfaces.

C. Overlap and seal all seams in strict accordance with the manufacturers written installation instructions.

3.3 PROTECTION

A. Protect completed vapor barrier during installation of the concrete slab on grade.

B. Repair and seal all punctures that may occur prior or during installation.

C. Vapor barrier shall be continuously sealed at all joints and projections.

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SECTION 07 54 16
KETONE ETHYLENE ESTER (KEE) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Adhered ketone ethylene ester (KEE) roofing system.
2. Accessory roofing materials.
3. Walkways.

1.3 CODE COMPLIANCE

A. General: Roofing membrane system shall meet the requirements of the Florida Building Code.

1. Provide Florida Product Approval information for thermoplastic membrane roofing system; include product evaluations and installation requirements indicating compliance.

1.4 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.5 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, Construction Manager, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Construction Manager, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.6 ACTION SUBMITTALS

A. Product Approval: Submit current Product Approval documentation in accordance with the Florida Building Code.

B. Product Data: For each type of product.

1. For insulation and roof system component fasteners, include copy of SPRI's Directory of Roof Assemblies.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tapered insulation, including slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Tie-in with air barrier.

D. Samples for Verification: For the following products:

1. Roof membrane and flashing, of color required.
2. Walkway pads or rolls, of color required.

E. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

a. Submit evidence of compliance with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Evaluation Reports: For components of roofing system, from ICC-ES.

D. Field Test Reports:

1. Concrete internal relative humidity test reports.
2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

E. Field quality-control reports.

F. Sample Warranties: For manufacturer's special warranties.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.9 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers: A qualified manufacturer that is UL listed, listed in FM Approvals' RoofNav or listed in SPRI's Directory of Roof Assemblies for roofing system identical to that used for this Project.
2. Installers: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.11 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.12 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, and other components of roofing system.
2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, and walkway products, for the following warranty period:

1. Warranty Period: Two years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and base flashings to remain watertight.

1. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746 or ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:

1. Zone 1 (Roof Area Field): As indicated on the drawings.
2. Zone 2 (Roof Area Perimeter) : As indicated on the drawings.

    a. Location: From roof edge to distance as indicated on the drawings, from inside roof edge.

3. Zone 3 (Roof Area Corners): As indicated on the drawings..

    a. Location: From roof edge to distance as indicated on the drawings, from inside roof edge.

D. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.

E. Energy Performance: Roofing system to have an initial solar reflectance and an emissivity as required by the Florida Building Code, when tested in accordance with ANSI/CRRC S100.

F. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 KETONE ETHYLENE ESTER (KEE) ROOFING

A. KEE Sheet: ASTM D6754/D6754M, fabric reinforced and fabric backed.

1. Basis of Design Product and Manufacturer; Seaman Corporation; FiberTite-SM 60-mil Membrane: Nominal 60 mil ketone ethylene ester (KEE) membrane reinforced with 5.0 oz per sq yd knitted polyester fabric. Or Subject to compliance with requirements a comparable product by the following:

    a. Carlisle Roofing.

2. Ketone Ethylene Ester (KEE) Content: Not less than 50 percent by weight of the polymer content of the sheet when tested in accordance with ASTM D8154.
3. Exposed Face Color: White.

B. Source Limitations: Obtain components for roofing system from manufacturer of roof membrane.

2.3 FLASHING MEMBRANE

A. Requirements to match field membrane and warranty expectations selected for roofing system.

1. FiberTite-SM Nominal 45 mil.

2.4 ANCILLARY MATERIALS

A. FiberTite Membrane Adhesives:

B. Alpha-Tite: VOC compliant solvent borne, contact (two-sided) bonding adhesive for bonding smooth-back FiberTite membranes to properly prepared and preauthorized horizontal and vertical substrates.

2.5 FASTENERS

A. Insulation Fasteners: FiberTite-HD: No. 14-13, heavy duty threaded steel No. 3 Phillips truss, self-tapping corrosion resistant fastener.

2.6 ADDITIONAL COMPONENTS

A. Flashing Terminations Sealant: FTR-101. Single-component gun-grade polyether.

B. Pitch Pans – Not Allowed.

C. Fabricated Metal Flashing: FiberClad Metal, Aluminum with PVC coating.

D. FTR Pre-molded Flashings: Injection molded vent stack, split Wrapid Flash and inside and outside corner flashing using FiberTite vinyl compound.

E. FTR Non-Reinforced Membrane: Field fabrication membrane, 60 mil non-reinforced vinyl membrane.

F. FTR-Termination Bar: Membrane flashings restraint and termination seals. 0.125 x 1 x 120 inch 6060-T5 extruded aluminum bar with pre-punched slots, 8 inches on center.

G. FTR-601 & FTR-601 PG: Dual component, single bead (ribbon applied) urethane insulation adhesive. Adhesive is a non-solvent, elastomeric, urethane adhesive, specifically designed for bonding single or multiple layers of roof insulation and insulation composites or cover boards to structural roof decks and base sheets.

H. FiberTite Seam Cleaner: FiberTite Seam Cleaner is to be used with clean white cotton cloths or rags to clean contamination from the seam areas of the membrane prior to welding.

I. FTR T Joint Covers: Pre-cut 4 x 4 inch 60 mil non-reinforced membrane to reinforce areas where three overlapping sheets of membrane intersect.

2.7 ACCESSORY ROOFING MATERIALS

A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as KEE sheet.

C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Roof Vents: As recommended by roof membrane manufacturer.

1. Size: Not less than 4-inch diameter.

E. Bonding Adhesive: Manufacturer's standard.

F. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

G. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.

H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.8 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

1. Size: Approximately 36 by 60 inches.
2. Color: Contrasting with roof membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.

2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 "Steel Decking."
4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
5. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer, when tested according to ASTM F2170.

    a. Test Frequency: One test probe per each 1000 sq. ft., or portion thereof, of roof deck, with no fewer than three test probes.
    b. Submit test reports within 24 hours of performing tests.

6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
7. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
8. Verify that minimum curing period recommended by roofing system manufacturer for lightweight insulating concrete roof decks has passed.
9. Verify that any damaged sections of cementitious wood-fiber decks have been repaired or replaced.
10. Verify that adjacent cementitious wood-fiber panels are vertically aligned to within 1/8 inch at top surface.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.

1. Submit test result within 24 hours of performing tests.

    a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

D. Install sound absorbing insulation strips according to acoustical roof deck manufacturer's written instructions.

3.3 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, SPRI's Directory of Roof Assemblies listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

3.4 INSTALLATION OF ADHERED ROOF MEMBRANE

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roof membrane and allow to relax before installing.

B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

E. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.

F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.

G. Apply roof membrane with side laps shingled with slope of roof deck where possible.

H. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.5 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 INSTALLATION OF WALKWAYS

A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.

1. Install flexible walkways at the following locations:

a. Perimeter of each rooftop unit.
b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
d. Top and bottom of each roof access ladder.
e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
f. Locations indicated on Drawings.
g. As required by roof membrane manufacturer's warranty requirements.

2. Provide 6-inch clearance between adjoining pads.
3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.

1. Infrared Thermography: Testing agency surveys entire roof area using infrared color thermography according to ASTM C1153.

a. Perform tests before overlying construction is placed.
b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection tests.
c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.

1) Cost of retesting is Contractor's responsibility.

d. Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture, if any.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.8 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.9 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <**Insert name of Owner**>.
2. Owner Address: <**Insert address**>.
3. Building Name/Type: <**Insert information**>.
4. Building Address: <**Insert address**>.
5. Area of Work: <**Insert information**>.
6. Acceptance Date: _____.
7. Warranty Period: <**Insert time**>.
8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

a. lightning;
b. peak gust wind speed exceeding <**Insert mph**>;
c. fire;
d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;

e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
f. vapor condensation on bottom of roofing; and
g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 54 16

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manufactured reglets with counterflashing.
2. Formed roof-drainage sheet metal fabrications.
3. Formed steep-slope roof sheet metal fabrications.
4. Aluminum Soffits.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following

1. Underlayment materials.
2. Elastomeric sealant.
3. Butyl sealant.
4. Epoxy seam sealer.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 3 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

D. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.

E. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

B. Special warranty.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested and, shop shall be listed as able to fabricate required details as tested and approved.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup of typical roof eave, including gutter, approximately 10 feet long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish:

a. Metallic Fluoropolymer: AAMA 2605. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range.
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

C. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed; with smooth, flat surface.

1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled).

    a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
    b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

        1) Run grain of directional finishes with long dimension of each piece.
        2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

D. Lead Sheet: ASTM B749 lead sheet.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Carlisle WIP Products; a brand of Carlisle Construction Materials.
    b. GCP Applied Technologies Inc.
    c. Henry Company.

2. Source Limitations: Obtain underlayment from single source from single manufacturer.
3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Aluminum Vented Soffit:

1. Material: Aluminum, prefinished .032 inches thick.
2. Finish 2-coat fluoropolymer.

    a. Color: Selected from manufacturer’s standard range of colors.
    b. Free Area Ventilation: 10 sq. in. per 1’-0”.

2.5 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

C. Solder:

1. For Stainless Steel: ASTM B32, Grade Sn96, with acid flux of type recommended by stainless steel sheet manufacturer.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

I. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

J. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fry Reglet Corporation.
b. Heckmann Building Products, Inc.
c. Hohmann & Barnard, Inc.

2. Source Limitations: Obtain reglets from single source from single manufacturer.
3. Material: Aluminum, 0.024 inch thick.

4. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
5. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
6. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
7. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
8. Accessories:

    a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
    b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.

9. Finish: With manufacturer's standard color coating.

2.6 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:

1. Stainless Steel: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.7 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:

1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate in minimum 96-inch-long sections.
3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
4. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
5. Gutter Profile: As indicated, in accordance with cited sheet metal standard.
6. Expansion Joints: Lap type.
7. Gutters with Girth up to 15 Inches: Fabricate from the following materials:

    a. Aluminum: 0.050 inch thick.

B. Downspouts: Fabricate round and rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

    a. Aluminum: 0.125 inch thick.

C. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Scupper flanges shall be pre-coated with material compatible with adhesion of roofing membranes. Fabricate from the following materials:

1. Aluminum: 0.050 inch thick.

D. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:

1. Aluminum: 0.050 inch thick.

E. Splash Pans: Fabricate to dimensions and shape required and from the following materials:

1. Aluminum: 0.050 inch thick.

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates. Shop fabricate interior and exterior corners.

1. Joint Style: Overlapped, 4 inches wide.
2. Fabricate with scuppers spaced 10 feet apart, to dimensions required with 4-inch-wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
3. Fabricate from the following materials:

a. Aluminum: 0.050 inch thick.

B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external and interior legs. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.

1. Joint Style: Butted with expansion space and 6-inch-wide, concealed backup plate.
2. Fabricate from the following materials:

a. Aluminum: 0.063 inch thick.

C. Roof and Roof-to-Wall Transition Expansion-Joint Cover: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum: 0.050 inch thick.

D. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum: 0.040 inch thick.

E. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum: 0.050 inch thick.

F. Flashing Receivers: Fabricate from the following materials:

1. Aluminum: 0.050 inch thick.

G. Roof-Penetration Flashing: Fabricate from the following materials:

1. Lead: 4 lb.

H. Roof-Drain Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.0156 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment:

1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
2. Prime substrate if recommended by underlayment manufacturer.
3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
6. Roll laps and edges with roller.
7. Cover underlayment within 14 days.

B. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

1. Install in shingle fashion to shed water.
2. Lapp joints not less than 4 inches.

3.3 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder or sealant.

3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

    a. Embed hooked flanges of joint members not less than 1 inch into sealant.
    b. Form joints to completely conceal sealant.
    c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
    d. Adjust setting proportionately for installation at higher ambient temperatures.

        1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

1. Pretin edges of sheets with solder to width of 1-1/2 inches; however, reduce pretinning where pretinned surface would show in completed Work.
2. Do not solder aluminum sheet.
3. Do not use torches for soldering.
4. Heat surfaces to receive solder, and flow solder into joint.

    a. Fill joint completely.
    b. Completely remove flux and spatter from exposed surfaces.

5. Stainless Steel Soldering:

    a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
    b. Promptly remove acid-flux residue from metal after tinning and soldering.
    c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

H. Rivets: Rivet joints in aluminum where necessary for strength.

3.4 INSTALLATION OF ROOF-DRAINAGE SYSTEM

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:

1. Join sections with riveted sealed with sealant.
2. Provide for thermal expansion.
3. Attach gutters at eave or fascia to firmly anchor them in position.
4. Provide end closures and seal watertight with sealant.
5. Slope to downspouts.
6. Fasten gutter spacers to front and back of gutter.
7. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing.
8. Anchor gutter with straps spaced not more than 30 inches apart to roof deck unless otherwise indicated, and loosely lock to front gutter bead.
9. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 feet apart. Install expansion-joint caps.

C. Downspouts:

1. Join sections with 1-1/2-inch telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 60 inches o.c.
4. Provide elbows at base of downspout to direct water away from building.
5. Connect downspouts to underground drainage system.

D. Splash Pans:

1. Install where downspouts discharge on low-slope roofs.
2. Set in asphalt roofing cement or elastomeric sealant compatible with the substrate.

E. Parapet Scuppers:

1. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
2. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
3. Loosely lock front edge of scupper with conductor head.
4. Seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

F. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper discharge.

G. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches in direction of water flow.

3.5 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Copings:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.

    a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
    b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches over base flashing.
3. Lap counterflashing joints minimum of 4 inches.
4. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.6 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.8 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 62 00

SECTION 07 72 33
ROOF HATCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Roof access hatches.

1.3 SUBMITTALS

A. Product Approval: Submit current Product Approval documentation in accordance with the Florida Building Code.

B. Product Data: For products indicated. Include construction details, materials, dimensions of individual components and profiles, and finishes.

C. Sample of specified Product for installation.

D. Shop Drawings: Show fabrication and installation details. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other Work.

1. Anchoring methods for roof accessories shall comply with the requirements of the Florida Building Code.

E. Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.

1.4 WARRANTY

A. Warranty Requirements: Manufacturer's standard form in which manufacturer agrees that roof hatches will be free of defects in material and workmanship within specified warranty period. Should a part fail to function in normal use within the warranty period the manufacturer shall furnish a new part at no charge.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural design of systems will be the responsibility of the manufacturer and is to be designed to comply with the Florida Building Code along with additional wind loading as follows:

1. Code Conformance: Design of system shall comply with the requirements of ASCE-7, latest edition adopted by D.O.E.except as modified by this section.

B. EHPA areas shall be designed for wind loads in accordance with ASCE-7, latest edition adopted by D.O.E., Category 111 (Essential Buildings). See architectural drawings for the building(s) required to comply with the EHPA requirement.

1. EHPA Building Envelope shall comply with SBCCI/SSTD-12 for large missile impact criteria. Refer to architectural drawings for building envelope path and location.

2.2 ROOF ACCESS HATCH

A. General: Fabricate units to withstand 40-lbf/sq. ft. live load. Provide double-wall cover (lid) construction with 1-inch insulation core. Provide gasketing and equip corrosion-resistant hardware including pintle hinges, hold-open devices, interior padlock hasps, and both interior and exterior latch handles.

B. Model and Manufacturer – Basis of Design: Milcor Type S-50 Roof Hatch.

C. Other manufacturers offering products which may be incorporated into the work but are not limited to the following:

1. Bilco Company
2. Babcock-Davis Hatchways, Inc.

D. Size: As indicated.

E. Cover: High strength composite panels with 11 gauge zinc-coated, prime-painted steel exterior and 18 gauge zinc-coated, prime painted steel liner bonded to core of 2” rigid foam insulation.

F. Curbs: 12 inches high, 14 gauge zinc-coated steel, 14 gauge zinc-coated steel integral counter-flashing, and one inch (1”) factory installed fiberboard insulation on the exterior and metal encased.

G. Hatch: Assembled with heavy steel pintle hinges, automatic locking hold-open arms, snap latch, turn handles, padlock hasp inside, and closed-cell rubber weather seal.

H. Hardware: Steel; provide engineered composite compression spring tubes. Steel compression springs with electro-coated acrylic finish. All other hardware shall be zinc plated/chromate sealed.

I. Safety Post on Ladders to Roof Hatches: LadderUp Safety Post.

1. Safety post shall be manufactured of high strength steel with telescoping tubular section that locks automatically when fully extended. Upward and downward movement shall be controlled by a stainless steel spring balancing mechanism.
2. Provide manufacturer's standard yellow powder coat finish.
3. Safety post shall extend up to 42" above the hatch curb.

J. Finish: Manufacturer's standard alkyd base red oxide primer.

2.3 MATERIALS, GENERAL

A. Galvanized Steel Sheet: ASTM A 653/A 653M with G90 coating designation; commercial quality, unless otherwise indicated.

1. Structural Quality: Grade 40, where indicated or as required for strength.

B. Insulation: Manufacturer's standard rigid or semi-rigid glass-fiber board of thickness indicated.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where fasteners are used in or come in contact with pressure treated wood, fasteners shall be Type 304 stainless steel.

2.5 FABRICATION

A. Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrications of units, including flanges, and cap flashing to coordinate with type of roofing indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written instructions. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weather tight. Anchor roof accessories securely to supporting structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.

1. Install roof accessory items according to construction details of NRCA's "Roofing and Waterproofing Manual," and manufacturer's instructions and recommendations.

B. Separation: Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with permanent separation.

C. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

3.2 CLEANING AND PROTECTION

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF SECTION 07 72 33

SECTION 07 72 36
SMOKE VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide labor, materials, and equipment necessary for furnishing and complete installation of prefabricated smoke vents as shown on the Drawings and specified herein.

1.3 SUBMITTALS

A. Product Approval: Submit current Product Approval documentation in accordance with the Florida Building Code.

B. Submit complete shop Drawings showing sizes, materials, and details of construction.

C. Submit copies of warranty as specified herein.

1.4 WARRANTY

A. Manufacturer shall warrant against defects in material or Workmanship for a period of 5 years from the Date of Substantial Completion.

1.5 QUALITY CONTROL

A. Comply with the Florida Building Code Current Edition.

B. Smoke vent shall have Florida Building Code approval.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Hatch-Type Heat and Smoke Vents: Manufacturer's standard, with double-walled insulated curbs, welded or mechanically fastened and sealed corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-walled lid and continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms and UL-listed fusible links rated at 360 deg F.

B. Basis of Design: Type “U-LP Acoustical STC-45 Heat and Smoke Vents by Milcor, specified as the type, size, function, and quality required.

1. Products of the following manufacturers are acceptable, providing their products equal or exceed the quality and function specified:

a. Babcock Davis
b. The Bilco Company.

2. Type and Size: As Indicated.

2.2 MATERIALS AND CONSTRUCTION

A. Covers: Upper covers shall be 14 gauge galvanized steel. Acoustical insulation of upper covers shall be 2” thick fully welded and protected by a 22 gauge galvanized steel cover liner. Lower covers shall be continuously hinged and shall be 14 gauge galvanized steel. Acoustical insulation in the lower covers shall be fully covered and protected by 22 gauge galvanized steel liner.

B. Curb shall be 18 inches in height and of 14 gauge galvanized steel, integral counterflashing, 3-1/2 inch wide mounting flange with holes, and one inch fiberboard insulation on the exterior. Acoustical insulation shall be fully covered and protected by a 22 gauge galvanized steel liner on the interior.

C. Hardware shall be zinc plated and chromate sealed.

D. Vent shall be assembled with a positive hold/release mechanism, heavy pintle hinges, compression spring operators, thermoplastic rubber gasket, heavy duty shock absorbers, and pull handles for inside and outside operation.

E. Operation

1. Covers shall automatically spring open to approximately 90 degrees in the event of fire, actuated by the parting of a single UL-listed or FM approved 165 degree fusible link, external electrical impulse of low power and short duration (fire alarm system), and a manual winch at the stage level.
2. Supply smoke vents with 24volt AC/DC “Electro-Thermal Link (ETL)”, and 120 VAC resettable solenoid as manufactured by Milcor, Lima, Ohio; or equal as provided by the other approved and listed manufacturers.
3. Upper covers shall be double leaf construction, equipped with sufficient torsion spring operators to open against a 10 psf snow or wind load. Lower covers shall spring down when smoke vent is activated.
4. Units shall be equipped with hydraulic shock absorbers to control opening speed and prevent over-travel.
5. Covers shall not open when subjected to upward pressure up to 30 psi.
6. Covers shall be able to be released manually from the stage floor by heavy duty winch as recommended by the smoke vent manufacturer and allowing complete closing of the vents from stage level, without disturbing the fusible link assembly.
7. Covers shall latch automatically and manual release mechanism resets automatically.

F. Smoke vents shall carry an STC-45 acoustical rating per ASTM E 90.

G. Prime Paint: All exposed steel shall be prime painted. Primer shall be compatible with finish coats as specified in Section 09 90 00, “Painting.” Verify primer compatibility in writing to the Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install smoke vents in strict accordance with the manufacturer's printed instructions and with reviewed Shop Drawings.

B. Provide all items and accessories as required for a complete and total installation in every respect.

3.2 GENERAL INSTALLATION PROVISIONS

A. Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

E. Recheck measurements and dimensions, before starting each installation.

F. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

G. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

3.3 ADJUSTMENT AND DEMONSTRATION

A. After installation, moving parts shall be properly adjusted to give free, effortless operation. Demonstrate to the Architect that components are fully operable and will perform as intended.

END OF SECTION 07 72 36

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SECTION 07 81 00
APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Concealed SFRM.

1.3 DEFINITIONS

A. SFRM: Sprayed fire-resistive material.

B. Concealed: Fire-resistive materials applied to surfaces that are concealed from view behind other construction when the Work is completed.

1.4 SUBMITTALS

A. Product Data: For products indicated.

B. Shop Drawings: Framing plans, schedules, or both indicating the following:

1. Locations and types of surface preparations required before applying SFRM.
2. Extent of fireproofing for each construction and fire-resistance rating.
3. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
4. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
5. Treatment of SFRM after application.

C. Qualification Data: For Installer and testing agency.

D. Product Certificates: For fireproofing.

E. Evaluation Reports: For fireproofing.

F. Preconstruction Test Reports: For fireproofing.

G. Compatibility and Adhesion Test Reports: From SFRM manufacturer indicating the following:

1. Materials have been tested for bond with substrates.
2. Materials have been verified by SFRM manufacturer to be compatible with substrate primers and coatings.
3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fireproofing.

I. Field Quality-Control Test Reports: Submit completed reports.

J. Preinstallation Meeting Reports: Submit meeting minutes.

K. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

B. Source Limitations: Obtain SFRM through one source from a single manufacturer.

C. Preinstallation Meeting: Conduct conference at Project site. Review methods and procedures related to SFRM including, but not limited to, the following:

1. Review products, exposure conditions, design ratings, restrained and unrestrained conditions, calculations, densities, thicknesses, bond strengths, and other performance requirements.
2. Review and finalize construction schedule and verify sequencing and coordination requirements.
3. Review weather predictions, ambient conditions, and proposed temporary protections for SFRM during and after installation.
4. Review surface conditions and preparations.
5. Review field quality-control testing procedures.

D. Fire-Test-Response Characteristics: Provide SFRM with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting age cy acceptable to authorities having jurisdiction. Identify bags containing SFRM with appropriate markings of applicable testing and inspecting agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" acceptable to authorities having jurisdiction, for SFRM serving as direct applied protection tested per ASTM E119.
2. Surface-Burning Characteristics: ASTM E84.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.

B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.

C. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply SFRM when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing a minimum 4 complete air exchanges per hour and according to manufacturer's written instructions until Spray-Applied Fire Resistive Materials are dried and cured. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

1.8 COORDINATION

A. Sequence and coordinate application of SFRM with other related work specified in other Sections to comply with the following requirements:

1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
4. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
5. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
6. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
7. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
8. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace SFRMs that fail in materials within specified warranty period.

B. Failures include, but are not limited to, the following:

1. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of SFRM from substrates.
2. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.

C. Warranty Period: Two years from Date of Final Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

A. Standard Durability SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application. Dry mix sprayed fire resistive materials containing mineral fibers are not allowed.

1. Products: Subject to compliance with requirements, provide the following:

a. Grace Construction Products; W.R. Grace & Co. -- Conn; Monokote MK-6 Series (basis of design)
b. Isolatek International, Inc; Cafco 300
c. Pyrok, Inc.

2. Bond Strength: Minimum 200-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.

3. Density: Not less than 15 lb/cu. ft. and as specified in the approved fire-resistance design, according to ASTM E 605.
4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch.
5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 0.
    b. Smoke-Developed Index: 0.

6. Compressive Strength: Minimum 10 lbf/sq. in. according to ASTM E 761.

B. Medium Durability SFRM for Exposed Columns in Mechanical Room: Manufacturer's standard, factory-mixed, Portland cement based dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application. Dry mix sprayed fire resistive materials containing mineral fibers are not allowed.

1. Products: Subject to compliance with requirements, provide the following:

    a. Grace Construction Products; W.R. Grace & Co. -- Conn.; Monokote Z-106/HY (basis of design)
    b. Isolatek International, Inc; Cafco 400
    c. Pyrok, Inc.

2. Bond Strength: Minimum 2,000-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
3. Density: Not less than 22 lb/cu. ft. and as specified in the approved fire-resistance design, according to ASTM E 605.
4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 0.
    b. Smoke-Developed Index: 0.

6. Compressive Strength: Minimum 100 lbf/sq. in. according to ASTM E 761.

2.3 AUXILIARY FIRE-RESISTIVE MATERIALS

A. General: Provide auxiliary fire-resistive materials that are compatible with SFRM and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:

1. Primer's bond strength complies with requirements specified in UL's "Fire Resistance Directory" for coating materials based on a series of bond tests per ASTM E736.
2. Primer is identical to those used in assemblies tested for fire-test-response characteristics of SFRM per ASTM E119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of SFRM.

D. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by manufacturer of SFRM.

E. Topcoat: Type recommended in writing by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:

1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Application of the fireproofing shall not begin until the contractor, applicator and fireproofing testing laboratory (inspector) have examined surfaces to receive fireproofing and determined that the surfaces are acceptable to receive the fireproofing material.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for application procedures, and types of equipment used to apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

E. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

F. Extend fireproofing in full thickness over entire area of each substrate to be protected.

G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Test and inspect as required by the IBC and authorities having jurisdiction.

2. For reference, utilize AWCI - Inspection Procedure for Field-Applied Sprayed Fire-Resistive Materials, Technical Manual 12-A; an annotated guide.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation.

END OF SECTION 07 81 00

SECTION 07 84 13
PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Through-penetration firestop systems for penetrations through the following fire-resistance-rated assemblies, including both empty openings and openings containing penetrating items:

    a. Walls and partitions.
    b. Floors and ceilings.
    c. Smoke barriers.

1.3 PERFORMANCE REQUIREMENTS

A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.

B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

1.4 SUBMITTALS

A. Product Data: For each type of through-penetration firestop system product indicated.

B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and Owners, and other information specified.

D. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.

E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed through-penetration firestop systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Installer Qualifications: An experienced installer who is qualified by having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.

C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.

2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:

   a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
   b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

      1) UL in "Fire Resistance Directory."

E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hilti, Inc.
2. 3M Fire Protection Products
3. Tremco, Inc.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

C. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:

a. Slag-/rock-wool-fiber insulation.
b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
c. Fire-rated form board.
d. Fillers for sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.

B. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.5 IDENTIFICATION

A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

1. The words: "Warning--Through-Penetration Firestop System--Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION 07 84 13

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SECTION 07 84 43
JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

B. Product Data: For each product.

C. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

C. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."
2) Intertek Group in its "Directory of Listed Building Products."

2.2 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.

1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 07 84 43

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sealants for interior and exterior applications.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

D. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

E. Field Test Report Log: For each elastomeric sealant application. Include information specified in "Field Quality Control" Article.

F. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

G. Product Test Reports: From a qualified testing agency indicating sealants comply with requirements, based on comprehensive testing of current product formulations.

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Manufacturer's Representative: Manufacturer's representative shall certify the installation of sealant materials and shall attend pre-construction meetings, make site visits during construction and after completion of each phase of work that directly applies to the materials being installed before issuing a warrantee certification.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of sealant and backing installation; minimum length 8 feet.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degrees F.
3. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: As specified beginning from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Products: Provide the following products for each application listed. Substitutions for exterior building joint sealants shall be listed on the Validated Products list published by the Sealant, Waterproofing, and Restoration Institute (SWRI).

1. Joint Sealant - One-Part: For precast concrete, poured-in-place concrete, and concrete-to-concrete and concrete-to-masonry; one-part silicone sealant, having a joint movement capability of plus-or-minus 100% elongation, minus 50% compression, and Shore A durometer hardness of 15.

a. Product and Manufacturer:

1) Dow Corning 790 Silicone Building Sealant; Dow Corning Corp.

b. Warranty: Manufacturer's standard 20-year warranty.
c. Color: Shall Be Custom. Color shall be mixed to color as approved by the Architect.

2. Joint Sealant - One-Part: For masonry-to-aluminum, steel-to-aluminum, concrete-to-aluminum, steel-to-steel, and other metal-to-metal joints (including KYNAR coatings); one-part silicone sealant having a joint movement capability of plus-or-minus 50% elongation, and Shore A durometer hardness of 30.

a. Product and Manufacturer:

1) Dow Corning 795 Silicone Building Sealant; Dow Corning Corp.

b. Warranty: Manufacturer's extended 20-year warranty.

3. Joint Sealant – One Part: For exterior Masonry Control Joints and Expansion Joints; one-part urethane nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

    a. Product and Manufacturer:

        1) BASF Corporation; Sonolastic NP-1.
        2) Pecora Corporation; Dynatrol I-XL.
        3) Polymeric Systems, Inc; Flexiprene 1000.
        4) Tremco Incorporated; Dymonic.

4. Joint Sealant - Two-Part, Pourable Urethane Sealant: For horizontal joints, exterior and interior; provide joint sealant with a joint movement capability of plus-or-minus 25%.

    a. Products and Manufacturers: Provide one of the following.

        1) Vulkem 245; Tremco, Inc.
        2) NR200 Urexpan; Pecora Corp.
        3) Sikaflex 2c SL; Sika Corp.
        4) THC-900; Tremco, Inc.

    b. Warranty: Manufacturer's extended 5-year warranty.

5. Pick-Proof Sealant: For exterior joints within reach; one-part polyurethane sealant meeting ASTM C 920, Type S, Grade NS, Class 12.5.

    a. Products and Manufacturers: Provide one of the following:

        1) DynaFlex SC; Pecora Corp.; provide primers P75 or P150 as required for substrates indicated.
        2) Sikaflex 2C NS TG; Sika

    b. Warranty: Manufacturer’s standard warranty.

6. Joint Sealant - Two-Part Urethane Non-Sag Sealant: For general interior use; provide joint sealant with a joint movement capability of plus-or-minus 50%.

    a. Products and Manufacturers: Provide one of the following.

        1) Vulkem 922; Tremco, Inc.
        2) Dynatrol II; Pecora Corp.
        3) Sikaflex 2c NS; Sika Corp.
        4) NP II; Sonneborne Building Products Division, ChemRex, Inc.

    b. Warranty: Manufacturer's extended 5-year warranty.

7. Joint Sealant - One-Part Latex Sealant: For interior use for horizontal and vertical joints around door frames, and joints between dissimilar materials.

    a. Products and Manufacturers: Provide one of the following.

        1) AC-20 + Silicone; Pecora Corp.
        2) Sherwin Williams; 850A
        3) Sonolac; Sonneborn Building Products Div., ChemRex, Inc.

4) Tremflex 834; Tremco, Inc.

b. Warranty: Manufacturer's standard warranty.

8. Joint Sealant - Acoustic Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

a. Product and Manufacturer: Provide the following.

1) Pecora Corporation; AC-20 FTR.
2) USG Corporation; SHEETROCK Acoustical Sealant.

9. One-Part Silicone - Sanitary Sealant: For Interior use at plumbing fixtures in toilets and janitor closets, and horizontal and vertical joints of dissimilar materials in toilets and other wet areas.

a. Products and Manufacturers: Provide one of the following.

1) Dow Corning 786 Silicone Mildew Resistant Sealant; Dow Corning Corp.
2) SCS1700 Sanitary; General Electric Co.
3) Pecora 898 Silicone Mildew Resistant Silicone Sealant; Pecora Corp.
4) Tremsil 200; Tremco, Inc.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.3 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Backer Rod (Joint Fillers, Compressible Filler): Type B, ASTM C 1330, preformed, cylindrical, flexible, compressible, resilient, non-staining, bi-cellular material, with a density of 24-48 km/m3 per ASTM D1622, tensile strength greater than 200 kPa per ASTM D 1623, and water absorption less than 0.1 g/cc per ASTM C 1016.

1. Product and Manufacturer - Basis of Design:

a. Sof Rod; Nomaco, Inc., Zebulon, NC.

2. Other Acceptable Manufacturers: Manufacturers offering products having performance characteristics meeting or exceeding those specified may be incorporated into the Work.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Verify location and application of acoustical sealant and all other sealants indicated. Do not allow sealants to come into contact with incompatible materials. Prevent reaction to metals and other substances; protect all surfaces.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates, unless otherwise recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience.

1. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

1. Install sealants by proven techniques and at the same time backings are installed.
2. Place sealants so they directly contact and fully wet joint substrates.
3. Completely fill recesses provided for each joint configuration.
4. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

B. Backing Materials: Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

C. Bond-Breaker Tape: Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.

D. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Perform field-test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:

a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.
b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants by hand-pull method described below:

a. Make knife cuts from one side of joint to the other, followed by two cuts approximately 2 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from crosscut end of 2-inch piece.

b. Use fingers to grasp 2-inch piece of sealant between cross-cut end and 1-inch mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
c. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.

3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
4. Inspect tested joints and report on the following:

a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field- adhesion hand-pull test criteria.
b. Whether sealants filled joint cavities and are free from voids.
c. Whether sealant dimensions and configurations comply with specified requirements.

5. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
6. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

B. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 07 92 00

SECTION 07 95 13
EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Expansion control systems.

1.3 SUBMITTALS

A. Product Data: Include the following information in tabular form:

1. Manufacturer and model number for each expansion control system.
2. Expansion control system location cross-referenced to Drawings.
3. Nominal joint width.
4. Movement capability.
5. Materials, colors, and finishes.

B. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blockout requirement, attachments to other work, and line diagrams showing entire route of each expansion control system. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples for Verification: For each type of expansion control system indicated, full width by 6 inches long in size.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Provide factory-fabricated expansion joint cover assembly systems capable of withstanding the types of loads and of accommodating the kinds of movement, and the other functions for which they are designed including those specified below, without failure. Types of failure include those listed in Appendix X3 of ASTM E 1399.

1. Exterior Joints: Maintain continuity of weather enclosure.
2. Joints in Fire-Resistance-Rated Assemblies: Maintain fire-resistance ratings of assemblies.

3. Joints in Smoke Barriers: Maintain integrity of smoke barrier.
4. Other Joints: Where indicated, provide joint systems that prevent penetration of water, moisture, and other substances deleterious to building components or content.
5. Joints in Surfaces with Architectural Finishes: Serve as finished architectural joint closures.

2.2 SYSTEM DESCRIPTION

A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.

1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.

B. Coordination: Coordinate installation of exterior wall and soffit expansion control systems with roof expansion control systems to ensure that wall transitions are watertight. Roof expansion joint assemblies are specified in Division 07 Sections.

2.3 EXPANSION CONTROL SYSTEMS

A. Basis of Design: Balco, Inc. Subject to compliance with requirements, provide the products specified as follows:

1. Exterior Expansion Joints:

a. Wall to Wall: Balco BCSW-150, Silicone Face.

1) Size: 1-1/2”.
2) Color: as indicated on the Drawings.

b. Roof to Roof: Balco FR-Straight Curb, aluminum roof cover. Provide endcaps.

1) Size: 1-1/2”.
2) Color: mill finish.

2. Interior Expansion Joints:

a. Floor to Floor-Elevated Slabs: Balco BCP-2-150.

1) Size: 7” X 1/4”.
2) Color: mill finish.

b. Floor to Wall (exposed Visible): Balco BCPL-2-150.

1) Size: 4.75” x 1/4”.
2) Color: mill finish.

c. Wall to Wall: Balco 75FWG-Drywall.

1) Size: 1.5”.
2) Color: As selected by Architect from Manufacturers full range.

d. Ceiling to Ceiling (ACT): Balco 75FCA - Acoustic Ceiling.

1) Size: 1.5”.
2) Color: As selected by Architect from Manufacturers full range.

B. Products of the following manufacturers are also acceptable providing compliance with all specified requirements.

1. Architectural Art Manufacturing, Inc.
2. C/S Group
3. MM Systems Corporation
4. Watson Bowman Acme Corp., dugussa
5. InPro Corporation

2.4 FIRE RATED EXTERIOR WALL EXPANSION JOINT

A. Basis of Design Product and Manufacturer: Emseal, Model WFR2; Subject to compliance with requirements, other acceptable Manufacturers providing products specified as follows:

1. Architectural Art Manufacturing, Inc.
2. Balco, Inc.
3. MM Systems Corporation.
4. Watson Bowman Acme Corp., dugussa.
5. InPro Corporation.

2.5 MATERIALS

A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Extruded Preformed Seals: Single or multicellular elastomeric profiles as classified under ASTM D 2000, designed with or without continuous, longitudinal, internal baffles. Formed to fit compatible frames, in color indicated or, if not indicated, as selected by Architect from manufacturer's standard colors.

C. Preformed Sealant: Manufacturer's standard elastomeric sealant complying with ASTM C 920, use T, factory-formed and -bonded to metal frames or anchor members; in color indicated or, if not indicated, as selected by Architect from manufacturer's standard colors.

1. Joints 2 Inches Wide and Less: Withstand plus or minus 35 percent movement of the joint width without failure.

D. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion control system manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion control systems.

1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper expansion control system installation and performance.
3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
4. Repair or grout blockout as required for continuous frame support using nonmetallic, shrinkage-resistant grout.

5. Install frames in continuous contact with adjacent surfaces.

   a. Shimming is not permitted.

6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION 07 95 13

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Division 08
Openings

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SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel doors.
2. Steel frames for doors and windows.

1.3 DEFINITIONS

A. Steel Sheet Thickness: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.4 SUBMITTALS

A. Product Approval: Submit current Product Approval in accordance with the Florida Building Code.

B. Engineering Responsibility: Prepare engineering data for exterior steel doors and frames including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project signed and sealed by a professional engineer registered in the state of Florida.

C. Testing and Labeling: Comply with the Florida Building Code. Submit manufacturer's certification indicating compliance.

D. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, and finishes.

E. Certification: Provide written certification indicating Code compliance for all exterior doors and frames.

F. Shop Drawings: SDI-106 Recommended Standard Door Type Nomenclature and SD-111 Recommended Standard Details for Steel Doors & Frames shall be used as a guide in the development of Schedules and Shop Drawings.

1. Show the following:

a. Elevations of each door design.
b. Indicate location, size, door and frame types, rating and hand of each door.
c. Indicate door construction, details and methods of assembling sections, hardware locations, anchorage & fastening methods and finish requirements.
d. Coordination of glazing frames and stops with glass and glazing requirements.
e. Include anchoring details engineered to meet wind load requirements to comply with the Code.
f. Utilize same designation as Architect's door mark.

G. The steel door and frame supplier shall furnish to the architect (4) complete copies of the proposed steel door and frames schedule and/or shop drawings. Using the same reference number for details and openings as those on the contract drawings. After receipt of the approved door schedule the steel door and frame supplier will make any corrections and resubmit to the architect (6) sets of corrected schedules.

H. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

I. Samples:

1. Submit sample of typical mitered, welded doorframe corner for quality verification.
2. Samples shall be specifically required for non-specified manufacturer's products submitted as a Substitution.

J. Product Certificates: Product certificates shall be required by manufacturers of non-named products certifying that each product furnished meets the Specifications and with individual project requirements for the purpose intended. Certificates shall be submitted with Shop Drawings.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Employ only experienced Contractors (Installers) skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five years.

B. Supplier Qualifications: Supplier shall be regularly engaged in contract work and be staffed to expedite the work. The firm shall have been furnishing material for projects of similar scope, in the vicinity, for not less than 5 years. At the Owner's request the supplier shall send qualified representatives to the job site when needed during the course of installation. The supplier shall be or shall employ a Certified Door Consultant (CDC), certified by DHI, who shall be available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

C. Source Limitations: Obtain steel doors and frames through one source from a single manufacturer.

D. Steel Door and Frame Standard: Comply with requirements contained in SDI 100 Recommended Specifications for Standard Steel Doors and Frames unless more stringent requirements are indicated.

E. Preparation/Field Verification

1. Verify doorframes are in proper location and have been properly anchored in accordance with Specifications and SDI 105 Recommended Erection Instruction for Steel Frames.
2. Verify that frames comply with indicated requirements for type, size, location and swing characteristics. Verify that frames have been installed with plumb jambs and level heads.
3. Verify that Shop Drawings have been successfully submitted, reviewed and returned.

F. Frame Tolerances: Utilize UNF Frame Tolerance Check List Report for each opening to verify proper installation.

1. Initiate reports after installation of frame and prior to installation of adjacent walls or construction. Re-verify report during and after completion of adjacent construction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage.

B. Doors shall be individually wrapped, protected and packaged as standard of manufacturer.

C. Each door shall be marked on top and bottom rail with same opening number used on Shop Drawings.

D. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

E. Store doors and frames at building site under cover. Place units on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

1. Non-galvanized stock must be stored in a trailer or equivalent.

1.7 WARRANTY

A. Manufacturer’s Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Failure to meet performance requirements.
   b. Structural failures including excessive deflection.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Provide exterior opening capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified.

B. All exterior openings (other than EHPA) shall meet the following minimum requirements:

1. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone indicated.

a. Large-Missile Test: For glazing located within 30 feet of grade.
b. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.

2. Openings in EHPA shall meet enhanced Performance Requirements as listed below.

C. Structural design of systems will be the responsibility of the manufacturer and is to be designed to comply with the Florida Building Code along with additional wind loading as follows:

1. Code Conformance: Design of system shall comply with the requirements of ASCE-7, latest edition adopted by D.O.E. except as modified by this section.

D. EHPA areas shall be designed for wind loads in accordance with ASCE-7, latest edition adopted by D.O.E., Category 4 (Essential Buildings). See architectural drawings for the building(s) required to comply with the EHPA requirement.

1. EHPA Building Envelope shall comply with SBCCI/SSTD-12 for large missile impact criteria. Refer to architectural drawings for building envelope path and location.

E. Codes Compliance: Comply with requirements of the Florida Building Code for wind and impact resistance.

F. Wind Loads: As indicated on Drawings.

2.2 MANUFACTURERS

A. Product and Manufacturer: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:

1. Steel Doors and Frames:

a. Amweld Building Products, Inc.
b. Ceco Door Products
c. Curries Company
d. Steelcraft

2.3 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheets: ASTM A 366, Commercial Steel (CS), or ASTM A 620, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

C. Metallic-Coated Steel Sheets: ASTM A 653, Commercial Steel (CS), Type B, with an A40 zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

D. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches on center and not more than 2 inches on center from each corner.

2. All exterior glazed lites shall be wet glazed with Dow Corning Silicone 995.

a. Color: As Selected by Architect from Manufacturer full range.

2.4 STANDARD STEEL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.

1. Design: As indicated.
2. Thickness: As indicated.
3. Core Construction: Manufacturer's standard foamed-in-place polyurethane core that produces doors complying with ANSI A250.8.

a. Insulated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

1) Locations: As Indicated.

4. Vertical Edges for Single-Acting Doors: Beveled edge.

a. Beveled Edge: 1/8 inch in 2 inches.

5. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.
6. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick end closures or channels of same material as face sheets.
7. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

2.5 EXTERIOR DOORS

A. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Minimum SDI Level and Physical Performance: Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).
2. Face sheets shall be not less than 16 gauge (0.053 in) hot-dipped galvannealed steel sheets conforming to ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum A60 coating designation.
3. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

2.6 INTERIOR DOORS

A. General: Provide doors of sizes, thickness, and designs indicated.

B. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Minimum SDI Level and Physical Performance: Level 2 and Physical Performance Level A (Heavy Duty), Model 2 (Seamless).
2. Face sheets shall be not less than 18 gauge (0.042 in) hot-dipped galvannealed steel sheets conforming to ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum A60 coating designation.

2.7 FRAMES

A. General: ANSI A250.8 and with details indicated for type and profile.

1. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
2. Construction: Full profile welded.

B. Exposed Finish: Prime.

C. All frames installed in walls 8" or less thick are to be wrap around configuration.

D. Continuous equal face dimension profile: construct all door frames with corners saw-mitered and full (continuously) welded through the throat per HMMA 820 configuration "A", with all exposed welds ground and finished smooth.

E. Faces of unequal widths (4" head - 2" verticals and other horizontals): construct frames with 2" faces machine mitered and stops butted with head overlapping jambs and with jamb tabs interlocking slots in head member. Weld miters continuous, with all exposed welds ground and finished smooth. Filler caps, if required, to close end gaps at 4" head member, for all wrap-a-around frame locations are to be neatly sized and positioned and securely fastened in place. Any open joints in faces and returns which will be visible after installation are to be welded, ground and finished smooth, at the shop.

2.8 ACCESSORIES

A. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

B. Supports and Anchors: Fabricated from not less than 0.042-inch- thick, electrolytic zinc-coated or metallic-coated steel sheet.

1. Wall Anchors in Masonry Construction: 0.177-inch- diameter, steel wire complying with ASTM A 510 may be used in place of steel sheet.

C. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

D. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

E. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.

F. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

G. Bituminous Coating: Cold-applied asphalt mastic, two coats minimum 30-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.9 ELECTROLYSIS PREVENTION

A. Electrolysis Prevention: paint dissimilar metals, except stainless steel, white, bronze and/or solid zinc, with one heavy brush or spray coat of zinc-chromate primer and one coat of aluminum paint; or paint with one heavy brush coat of alkali-resistant bituminous paint; or separate from aluminum by heavy coat of mastic caulking compound or non-absorptive tape or gasket. Include dissimilar metals used in locations where drainage from them passes over aluminum.

2.10 FABRICATION

A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.

1. Face sheets shall be minimum 16 gauge (0.053 in) hot-dipped galvanized steel sheets conforming to ASTM A591, Commercial Steel (CS) Class B coating, mill phosphatized.

C. Exterior and Interior door cores shall be as listed below:

1. Fire door cores shall be rigid extruded polystyrene chemically bonded to all interior surfaces, fire retardant, closed cell board, Type 1, Density: 1 to 2 PCF, thermal values: R 6.0 minimum, conforming to ASTM C578.
2. Typical insulated door cores shall be rigid foam polyisocyanurate chemically bonded to all interior surfaces, closed cell, faced board, thermal value: R 12.3 minimum, conforming to ASTM C1289.

D. Clearances: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.

E. Single Acting, Door-Edge Profile: Beveled edge.

F. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

G. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

H. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

I. Prepare door frames for intrusion detection, provide 1-inch diameter holes on top jamb, 12-inches from strike side of the frame.

J. Frame Construction: Fabricate frames to shape shown.

1. Frames shall be welded construction type and have mitered or butted corners with welded and finished frame faces (seamless). The remaining elements of the frame profile, i.e., rabbet and stop, shall not be continuously welded.
2. Frames for exterior use shall have shall have mitered corners welded continuously and finished frame faces (seamless).
3. Frames shall be provided with temporary spreader bars for shipping and handling purposes.
4. Frames for exterior use shall be hot-dipped galvanized steel after fabrication.
5. Frames for paired doors shall be furnished with a removable center mullion, where indicated.
6. Mullions and transom bars shall be joined to adjacent members by welding so as to maintain alignment of parts and assure performance of completed frames. Face joints shall be welded and ground smooth (seamless).
7. Exterior frames shall be anchored in accordance with the Notice of Acceptance.
8. In addition, frames shall be provided with minimum 18-gauge base anchor. For existing masonry wall conditions that will not accept base anchor, an additional jamb anchor shall be provided.
9. Frames shall be furnished in manufacturer’s standard factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

K. Hardware Preparation

1. Provide minimum hardware reinforcing gauges as required in ANSI A250.6.
2. Doors and frames shall be reinforced, drilled and tapped to receive mortised hinges, locks, latches, flush bolts, closers, etc, as required in ANSI A115 and ANSI A250.6.
3. Doors shall be reinforced for specified surface-mounted hardware. Drilling and tapping may be completed at the job site by the installers.
4. Hardware shall be located in accordance with locations prescribed in ANSI A250.8/SDI 100.

L. Stops and Moldings: Provide stops and moldings around glazed lites, and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Single Glazed Lites panels: Provide fixed stops and moldings welded on secure side of hollow-metal work.

2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.11 FRAME GROUT

A. Standard masonry cement mortar for frames installed in concrete or masonry.

2.12 FINISHES

A. Factory Finish: Factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

1. Coat all surfaces including tops and bottoms of doors.

B. Frame and door stock is to be hot-dip galvanized conforming to ASTM A-526 & A-653 (A60)(0.60) ounces/SF total wt.).Modifications to this galvanized finish such as welds, end shears and the like are to be fully shop coated with a high quality zinc-rich paint minimum 2.0 mil thickness to insure against rusting while products are left exposed prior to finish painting.

C. Doors and frames are to be thoroughly cleaned and chemically treated to insure maximum paint adhesion. All surfaces of the door and frame exposed to view before installation shall receive a factory applied coat of rust inhibiting primer, either air-dried or baked-on. The finish shall meet the requirements for acceptance stated in ANSI A224.1 "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces". The prime finish is not intended to be the final layer of protection from the outside elements. Field painting shall be performed in accordance with the recommendations of the door and frame manufacturer. For specialty types of finished coatings, the paint supplier should also be consulted.

D. Field Finishing:

1. Doors and Frames: Refer to Section 09 91 00, “Painting.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install steel doors, frames and accessories according to Shop Drawings, manufacturer's data, and as specified.

B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

C. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-rated openings, install frames according to NFPA 80.
b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
c. Install frames with removable glazing stops located on secure side of opening.
d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply bituminous coating to backs of frames that will be filled with grout.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Walls: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Frames shall be fully grouted in place as directed below.

    a. Perimeter of all interior and exterior door and window frames are to be grouted solid when in contact with concrete/masonry.
    b. Perimeter of all door and window frames are to be grouted solid when in exterior frame walls.
    c. Coat throat (inside of jamb) continuously from bottom of jamb legs up to 18" A.F.F. with bituminous coating at all wet locations and where the floor finish shall be VCT.

6. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
8. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

D. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Standard Steel Doors:

    a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

E. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches on center and not more than 2 inches on center from each corner.

3.4 PROTECTION DURING CONSTRUCTION

A. Steel doors shall be protected at all times during construction. After installation, take appropriate measures to protect doors from abuse.

B. Replace doors and frames that are damaged or do not comply with requirements. Doors and frames may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

3.5 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 11 13

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Flush Wood Doors.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Factory-machining criteria.
7. Factory- finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
4. Dimensions and locations of blocking for hardware attachment.
5. Dimensions and locations of mortises and holes for hardware.
6. Clearances and undercuts.
7. Requirements for veneer matching.
8. Doors to be factory finished and application requirements.
9. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
3. Louver blade and frame sections, 6 inches long, for each material and finish specified.
4. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

C. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on bottom with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during remainder of construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Provide labels and certificates from AWI certification program indicating that doors comply with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.3 SOLID-CORE FLUSH WOOD VENEER-FACED DOORS

A. Interior Doors:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on the Finish Schedule, or comparable product by one of the following:

    a. Eggers Industries.
    b. Masonite Architectural.
    c. Oshkosh Door Company.
    d. VT Industries Inc.

2. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty.
3. Architectural Woodwork Standards Grade: Premium.
4. Faces: Single-ply wood veneer not less than 1/50 inch thick.

    a. Species: As indicated on the Finish Schedule.
    b. Cut: As selected by Architect from Manufacturers full range.
    c. Match between Veneer Leaves: As selected by Architect from Manufacturers full range.

5. Exposed Vertical and Top Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A.

    a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
    b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
    c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

        1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.

6. Core for Non-Fire-Rated Doors:

    a. ANSI A208.1, Grade LD-2 particleboard.

        1) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 08 71 00 "Door Hardware."

    b. Glued wood stave.
    c. WDMA I.S. 10 structural composite lumber.

        1) Screw Withdrawal, Door Face: 550 lbf.
        2) Screw Withdrawal, Vertical Door Edge: 550 lbf.

    d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.

7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.

    a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.

8. Construction: Five or Seven plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Manufacturer's standard shape.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated on Drawings. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

C. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch-thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.

D. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Chevron.

E. Metal Louvers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Activar Construction Products Group, Inc.
    b. Allegion plc.
    c. Anemostat Products; a Mestek company.
    d. ASSA ABLOY.

2. Blade Type: Vision-proof, inverted Y.
3. Metal and Finish: Hot-dip galvanized steel, 0.040 inch thick, with baked-enamel- or powder-coated finish.

F. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Activar Construction Products Group, Inc.
b. Allegion plc.
c. Anemostat Products; a Mestek company.
d. ASSA ABLOY.

2. Metal and Finish: Hot-dip galvanized steel, 0.040 inch thick, with baked-enamel- or powder-coated finish.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels:

1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
2. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
3. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails.
4. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

E. Exterior Doors: Factory treat exterior doors with water repellent after fabrication has been completed but before factory finishing.

1. Flash top of outswinging doors with manufacturer's standard metal flashing.

2.6 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Factory finish doors that are indicated on Drawings to receive transparent finish.

D. Factory finish doors where indicated in schedules or on Drawings as factory finished.

E. Transparent Finish:

1. Architectural Woodwork Standards Grade: Premium.
2. Finish: ANSI/WDMA I.S. 1A TR-6 Catalyzed Polyurethane.
3. Staining: As indicated on the Finish Schedule.
4. Effect: As selected by Architect from Manufacturers full range.
5. Sheen: As selected by Architect from Manufacturers full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

a. Provide 1/8 inch at heads, jambs, and between pairs of doors.

b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
d. Comply with NFPA 80 for fire-rated doors.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

C. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of access doors:

1. Wall access doors.
2. Fire-rated wall access doors.
3. Ceiling access doors.
4. Fire-rated ceiling access doors.

1.3 SUBMITTALS

A. Product Data: For each type of access door assembly specified, including details of construction relative to materials, individual components, profiles, finishes, and fire-protection ratings (where required).

1. Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, latching or locking provisions, and other data pertinent to installation.

B. Shop Drawings: Showing fabrication and installation of customized access doors and frames, including details of each frame type, elevations of door design types, anchorage, and accessory items.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain access doors for entire Project from one source and by a single manufacturer.

B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per test method as indicated below, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Test Method for Vertical Installations: ASTM E 152.
2. Test Method for Horizontal Installations: ASTM E 119.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified under "Submittals" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Access Doors:

a. J.L. Industries.
b. Karp Associates, Inc.
c. Larsen's Manufacturing Co.
d. Milcor, Inc.
e. Nystrom, Inc.

2.2 MATERIALS AND FABRICATION

A. Steel Sheet: ASTM A 366 commercial-quality, cold-rolled steel sheet with baked-on, rust-inhibitive primer.

B. Furnish each access door assembly manufactured as an integral unit, complete and ready for installation.

C. Gypsum Board Walls and Ceilings: For gypsum board walls and ceilings, furnish perforated frames with drywall bead. Access door face shall be recessed to accept a single layer of 5/8 inch gypsum board. 16 gauge cold rolled steel frame with galvanized drywall taping bead attached to all four sides. Hinges shall be cold rolled with stainless steel pin, continuous piano type. Size: 24 x 24 inch, unless indicated otherwise.

D. Masonry Walls: For masonry construction, furnish frames with adjustable metal masonry anchors. Frames shall be 16 gauge cold rolled steel. Door shall be 20 gauge cold rolled steel. Hinges shall be cold rolled with stainless steel pin, continuous piano type. Size: 24 x 24 inch, unless indicated otherwise.

E. Latching Devices: Furnish flush, screwdriver operated cam locks of number required to hold door in flush, smooth plane when closed.

F. Provide one key-operated cam lock per access door. Furnish 2 keys per lock. Key locks alike, unless otherwise scheduled.

1. If only one latching device is required, then it shall be a key operated cam lock.

G. Access doors and frames shall be factory primed with manufacturers standard primer paint.

H. Provide UL Labeled, fire-rated access doors and panels when required to be installed in fire-rated walls or ceilings.

2.3 FABRICATION

A. General: Manufacture each access door assembly as an integral unit ready for installation.

B. Steel Access Doors and Frames: Continuous welded construction. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flange: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
2. For gypsum board assemblies or gypsum veneer plaster, furnish frames with edge trim for gypsum board or gypsum base.
3. For installation in masonry construction, furnish frames with adjustable metal masonry anchors.

C. Locking Devices: Furnish number required to hold door in flush, smooth plane when closed.

1. For cylinder lock, furnish 2 keys per lock and key all locks alike.
2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Advise Installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices. Furnish inserts and anchoring devices for access doors that must be built into other construction. Coordinate delivery with other work to avoid delay.

3.2 INSTALLATION

A. General: Comply with manufacturer's instructions for installing access doors.

1. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finished surfaces.
2. Install concealed-frame access doors flush with adjacent finish surfaces.
3. Paint exposed surface of access doors and frames to match adjacent surface finish.

3.3 ADJUST AND CLEAN

A. Adjust hardware and panels after installation for proper operation.

B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13

SECTION 08 33 13
COILING COUNTER DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Counter doors.
2. Fire-rated counter doors.

1.3 ACTION SUBMITTALS

A. Product Approval: Submit current Product Approval documentation in accordance with the Florida Building Code.

B. Product Data: For each type and size of coiling counter door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
3. Include description of automatic closing device and testing and resetting instructions.

C. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Show locations of controls, locking devices, detectors and other accessories.
5. Include diagrams for power, signal, and control wiring.

D. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

E. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats.
2. Bottom bar with sensor edge.
3. Guides.
4. Brackets.
5. Hood.
6. Laminate-clad counter panel product for each type, color, pattern, and surface finish; laminated to core.
7. Locking device(s).
8. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing and inspecting agency.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.
2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For coiling counter doors to include in maintenance manuals.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Counter Door Assemblies: Complying with NFPA 80; listed and labeled by qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.

1. Smoke Control: Where indicated and in corridors and smoke barriers, provide counter doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784; with maximum air-leakage rate of 3.0 cfm/sq. ft. of door opening at 0.10 inch wg for both ambient and elevated temperature tests.

B. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone indicated.

1. Large-Missile Test: For glazing located within 30 feet of grade.
2. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.

C. Structural Performance, Exterior Counter Doors: Capable of withstanding the following design wind loads:

1. Design Wind Load: As indicated on Drawings.
2. Testing: According to ASTM E330/E330M.
3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
4. Operability under Wind Load: Design overhead coiling counter doors to remain operable under design wind load, acting inward and outward.

2.2 MANUFACTURERS

A. Source Limitations: Obtain coiling counter doors from single source from single manufacturer.

1. Obtain operators and controls from coiling counter door manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Complying with NFPA 80; listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.

1. Smoke Control: Where indicated, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784; with maximum air-leakage rate of 3.0 cfm/sq. ft. of door opening at 0.10 inch wg for both ambient and elevated temperature tests.

2.4 COUNTER DOOR ASSEMBLY

A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cookson; a CornellCookson company.
b. Cornell; a CornellCookson company.
c. McKeon Rolling Steel Door Company, Inc.
d. Wayne-Dalton Corp.

B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.

C. Door Curtain Material: Galvanized steel.

D. Door Curtain Slats: Flat profile slats of 1-1/2-inch center-to-center height.

1. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

E. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated hot-dip galvanized steel and finished to match door.

F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

G. Hood: Match curtain material and finish.

1. Shape: As indicated on Drawings.
2. Mounting: As indicated on Drawings.

H. Locking Devices: Equip door with locking device assembly.

1. Locking Device Assembly: Single-jamb side locking bars, operable from inside and outside with cylinders.

I. Electric Door Operator:

1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
2. Motor Exposure: Interior.
3. Emergency Manual Operation: Chain type with chain bag.
4. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.

a. Sensor Edge Bulb Color: Black.

5. Control Station(s): Where indicated on Drawings.

J. Curtain Accessories: Equip door with smoke seals.

K. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.

2.5 FIRE-RATED COUNTER DOOR ASSEMBLY

A. Fire-Rated Counter Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cookson; a CornellCookson company.
    b. Cornell; a CornellCookson company.
    c. McKeon Rolling Steel Door Company, Inc.
    d. Wayne-Dalton Corp.

B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.

C. Fire Rating: As indicated.

D. Door Curtain Material: Galvanized steel.

E. Door Curtain Slats: Flat profile slats of 1-1/2-inch center-to-center height.

F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.

G. Hood: Match curtain material and finish.

1. Shape: As indicated on Drawings.
2. Mounting: As indicated on Drawings.

H. Locking Devices: Equip door with locking device assembly.

1. Locking Device Assembly: Single-jamb side locking bars, operable from inside and outside with cylinders.

I. Electric Door Operator:

1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
2. Motor Exposure: Interior.
3. Motor Electrical Characteristics:
4. Emergency Manual Operation: Chain type, with chain bag.
5. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.

    a. Sensor Edge Bulb Color: Black.

6. Control Station(s): Where indicated on Drawings.

J. Curtain Accessories: Equip door with smoke seals and automatic closing device.

K. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.

2.6 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 DOOR CURTAIN MATERIALS AND FABRICATION

A. Door Curtains: Fabricate coiling counter door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.8 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.028-inch-thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A653/A653M.

B. Removable Metal Soffit: Formed or extruded from same metal and with same finish as curtain if hood is mounted above ceiling unless otherwise indicated.

2.9 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinders: As specified in Section 08 71 00 "Door Hardware".
2. Keys: Three for each cylinder.

B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.10 CURTAIN ACCESSORIES

A. Smoke Seals: Equip each fire-rated door with replaceable smoke-seal perimeter gaskets or brushes for smoke and draft control as required for door listing and labeling by a qualified testing agency.

B. Automatic-Closing Device: Equip each fire-rated door with an automatic-closing device or holder-release mechanism and governor unit complying with NFPA 80 and an easily tested and reset release mechanism. Release mechanism for motor-operated doors shall allow testing without mechanical release of the door. Automatic-closing device shall be designed for activation by the following:

1. Building fire-detection, smoke-detection, and -alarm systems.

2.11 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.12 BACK-UP MANUAL DOOR OPERATORS

A. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

2.13 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.

1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

D. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

E. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.

1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

a. Self-Monitoring Type: Four-wire-configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.

F. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."

1. Type: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

G. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.14 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.15 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Fire-Rated Doors: Install according to NFPA 80.

D. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to furnish reports to Architect.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.
2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.6 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain coiling counter doors.

END OF SECTION 08 33 13

SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Service doors.
2. Insulated service doors.
3. Fire-rated service doors.
4. Fire-rated, insulated service doors.

1.3 ACTION SUBMITTALS

A. Product Approval: Submit current Product Approval documentation in accordance with the Florida Building Code.

B. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
3. Include description of automatic-closing device and testing and resetting instructions.

C. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
5. Show locations of controls, locking devices, detectors or replaceable fusible links, and other accessories.
6. Include diagrams for power, signal, and control wiring.

D. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

E. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats.
2. Bottom bar with sensor edge.
3. Guides.
4. Brackets.
5. Hood.
6. Locking device(s).
7. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing and inspecting agency.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.
2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Special warranty.

B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Complying with NFPA 80; listed and labeled by qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control: Where indicated and in corridors and smoke barriers, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784; with maximum air-leakage rate of 3.0 cfm/sq. ft. of door opening at 0.10 inch wg for both ambient and elevated temperature tests.

B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design," the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

C. General: Provide exterior opening capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified.

D. Structural design of systems will be the responsibility of the manufacturer and is to be designed to comply with the Florida Building Code along with additional wind loading as follows:

1. Code Conformance: Design of system shall comply with the requirements of ASCE-7, latest edition adopted by D.O.E. except as modified by this section.
2. Design Wind Load: As indicated on Drawings.
3. Testing: According to ASTM E330/E330M.
4. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

5. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

E. All exterior openings (other than EHPA) shall meet the following minimum requirements:

1. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone indicated.

a. Large-Missile Test: For glazing located within 30 feet of grade.
b. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.

2. Openings in EHPA shall meet enhanced Performance Requirements as listed below.

F. EHPA areas shall be designed for wind loads in accordance with ASCE-7, latest edition adopted by D.O.E., Category 4 (Essential Buildings). See architectural drawings for the building(s) required to comply with the EHPA requirement.

1. EHPA Building Envelope shall comply with SBCCI/SSTD-12 for large missile impact criteria. Refer to architectural drawings for building envelope path and location.

G. Codes Compliance: Comply with requirements of the Florida Building Code for wind and impact resistance.

H. Wind Loads: As indicated on Drawings.

2.3 DOOR ASSEMBLY

A. Service and Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cookson; a CornellCookson company.
b. Cornell; a CornellCookson company.
c. McKeon Rolling Steel Door Company, Inc.
d. Wayne-Dalton Corp.

B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.

C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E283.

D. Curtain R-Value: 6.0 deg F x h x sq. ft./Btu.

E. Door Curtain Material: As Indicated.

F. Door Curtain Slats: Flat profile slats.

1. Insulated-Slat Interior Facing: Metal.
2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

G. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from hot-dip galvanized steel and finished to match door.

H. Curtain Jamb Guides: Galvanized steel, matching door material with exposed finish matching curtain slats.

I. Hood: Match curtain material and finish.

1. Shape: As indicated on Drawings.
2. Mounting: As indicated on Drawings].

J. Locking Devices: Equip door with locking device assembly and chain lock keeper.

1. Locking Device Assembly: Single-jamb side locking bars, operable from inside with thumbturn outside with cylinder.

K. Manual Door Operator: Chain-hoist operator.

L. Electric Door Operator:

1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
2. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
3. Motor Exposure: Interior.
4. Emergency Manual Operation: Chain type with chain bag.
5. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.

    a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.

6. Control Station(s): Where indicated on Drawings.

M. Curtain Accessories: Equip door with smoke seals weatherseals and automatic-closing devices at locations indicated.

N. Door Finish:

1. Steel Finish: Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
2. Interior Curtain-Slat Facing: Finish as selected by Architect from manufacturer's full range.

2.4 FIRE-RATED DOOR ASSEMBLY

A. Fire-Rated Service and Insulated Service Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cookson; a CornellCookson company.
b. Cornell; a CornellCookson company.
c. McKeon Rolling Steel Door Company, Inc.
d. Wayne-Dalton Corp.

B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.

C. Fire Rating: As indicated with temperature-rise limit and with smoke control as indicated.

D. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E283.

E. Curtain R-Value: 6.0 deg F x h x sq. ft./Btu.

F. Door Curtain Material: As Indicated.

G. Door Curtain Slats: Flat profile slats.

1. Insulated-Slat Interior Facing: Metal.
2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

H. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from hot-dip galvanized steel and finished to match door.

I. Curtain Jamb Guides: Galvanized steel, matching door material with exposed finish matching curtain slats.

J. Hood: Match curtain material and finish.

1. Shape: As indicated on Drawings.
2. Mounting: As indicated on Drawings].

K. Locking Devices: Equip door with locking device assembly and chain lock keeper.

1. Locking Device Assembly: Single-jamb side locking bars, operable from inside with thumbturn outside with cylinder.

L. Manual Door Operator: Chain-hoist operator.

M. Electric Door Operator:

1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
2. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
3. Motor Exposure: Interior.
4. Emergency Manual Operation: Chain type with chain bag.
5. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.

a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.

6. Control Station(s): Where indicated on Drawings.

N. Curtain Accessories: Equip door with smoke seals weatherseals and automatic-closing devices at locations indicated.

O. Door Finish:

1. Steel Finish: Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
2. Interior Curtain-Slat Facing: Finish as selected by Architect from manufacturer's full range.

2.5 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.7 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.028-inch-thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A653/A653M.

2.8 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinders: As specified in Section 08 71 00 "Door Hardware" and keyed to building keying system.
2. Keys: Three for each cylinder.

B. Chain Lock Keeper: Suitable for padlock.

C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.9 CURTAIN ACCESSORIES

A. Smoke Seals: Equip each fire-rated door with replaceable smoke-seal perimeter gaskets or brushes for smoke and draft control as required for door listing and labeling by a qualified testing agency.

B. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.

1. At door head, use 1/8-inch-thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
2. At door jambs, use replaceable, adjustable, continuous, nylon brushes.

C. Automatic-Closing Device: Equip each fire-rated door with an automatic-closing device or holder-release mechanism and governor unit complying with NFPA 80 and an easily tested and reset release mechanism. Testing for manually operated doors shall allow resetting by opening the door without retensioning the counterbalance mechanism Automatic-closing device shall be designed for activation by the following:

1. Building fire-detection, smoke-detection, and -alarm systems.

2.10 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.11 MANUAL DOOR OPERATORS

A. General: Equip door with manual door operator by door manufacturer.

B. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

2.12 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.

1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

D. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

E. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.

1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

    a. Self-Monitoring Type: Four-wire-configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.

F. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

G. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.13 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.14 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.

D. Fire-Rated Doors: Install according to NFPA 80.

E. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

F. Power-Operated Doors: Install according to UL 325.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to furnish reports to Architect.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.
2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

1. Adjust exterior doors and components to be weather resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.6 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 08 33 23

SECTION 08 33 26
OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Open-curtain overhead coiling grilles.

1.3 SUBMITTALS

A. Product Data: For each type and size of overhead coiling grille and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for curtain components, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Show locations of controls, locking devices, and other accessories.
5. Include diagrams for power, signal, and control wiring.

C. Samples: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Open-curtain grille with full-size components consisting of rods, spacers, and links as required to illustrate each assembly.
2. Closed-curtain grille with full-size components consisting of ribs and infill as required to illustrate each assembly.
3. Bottom bar with sensor edge.
4. Guides.
5. Mounting frame.
6. Brackets.
7. Hood.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling grilles to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

PART 2 - PRODUCTS

2.1 OPEN-CURTAIN GRILLE ASSEMBLY

A. Open-Curtain Grille: Overhead coiling grille with a curtain having a network of horizontal rods that interconnect with vertical links.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Clopay Building Products.
b. Cookson Company.
c. Cornell Iron Works, Inc.
d. McKeon Rolling Steel Door Company, Inc.
e. Overhead Door Corporation.

B. Operation Cycles: Grille components and operators capable of operating for not less than 50,000. One operation cycle is complete when a grille is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.

C. Grille Curtain Material: Aluminum.

1. Rod Spacing: Approximately 2 inches o.c.
2. Link Spacing: Approximately 9 inches apart in a straight in-line pattern.
3. Spacers: Metal tubes matching curtain material.

D. Bottom Bar: Manufacturer's standard aluminum tube, 204-R1 clear anodized.

E. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

F. Hood: Match curtain material and finish.

1. Shape: As indicated on Drawings.
2. Mounting: As indicated on Drawings.

G. Locking Devices: Equip grille with slide bolt for padlock.

H. Electric Grille Operator:

1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
2. Operator Location: Top of hood.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
4. Motor Exposure: Interior.
5. Emergency Manual Operation: Chain type.
6. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.

    a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.

7. Control Station: Where indicated on Drawings.

I. Grille Finish:

1. Aluminum Finish: Clear anodized.

2.2 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

A. Open-Curtain Grilles: Fabricate metal grille curtain as an open network of horizontal rods, spaced at regular intervals, that are interconnected with vertical links, which are formed and spaced as indicated and are free to rotate on the rods.

1. Aluminum Grille Curtain: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Bottom Bar: Manufacturer's standard continuous shape unless otherwise indicated, finished to match grille.

C. Grille Curtain Jamb Guides: Manufacturer's standard shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.

1. Removable Posts and Jamb Guides: Manufacturer's standard.

2.4 HOODS AND ACCESSORIES

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Aluminum: 0.040-inch-thick aluminum sheet, complying with ASTM B 209, of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.

2.5 LOCKING DEVICES

A. Safety Interlock Switch: Equip power-operated grilles with safety interlock switch to disengage power supply when grille is locked.

2.6 ELECTRIC GRILLE OPERATORS

A. General: Electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operation cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each grille.

C. Grille Operator Location(s): Operator location indicated for each grille.

1. Top-of-Hood Mounted: Operator is mounted to the right or left grille head plate, with the operator on top of the grille-hood assembly and connected to the grille drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.

D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.

1. Electrical Characteristics:

   a. Phase: Polyphase.
   b. Volts: 208 V.
   c. Hertz: 60.

2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate grille in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
3. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip motorized grille with adjustable switches interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.

F. Obstruction-Detection Device: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of grille opening. Activation of sensor immediately stops and reverses downward grille travel.

1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

a. Self-Monitoring Type: Four-wire configured device designed to interface with grille operator control circuit to detect damage to or disconnection of sensor edge.

G. Control Station: Three-position keyed control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Manual Operation: Equip electrically powered grille with capability for emergency manual operation. Design manual mechanism so required force for grille operation does not exceed 25 lbf.

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Mill Finish: Manufacturer's standard.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ELECTROLYSIS PREVENTION

A. Electrolysis Prevention: paint dissimilar metals, except stainless steel, white, bronze and/or solid zinc, with one heavy brush or spray coat of zinc-chromate primer and one coat of aluminum paint; or paint with one heavy brush coat of alkali-resistant bituminous paint; or separate from aluminum by heavy coat of mastic caulking compound or non-absorptive tape or gasket. Include dissimilar metals used in locations where drainage from them passes over aluminum.

3.3 INSTALLATION

A. Install overhead coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports, according to manufacturer's written instructions and as specified.

B. Install overhead coiling grilles, hoods, controls, and operators at the mounting locations indicated for each grille.

C. Accessibility: Install overhead coiling grilles, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Grilles: Install automatic garage grille openers according to UL 325.

3.4 STARTUP SERVICE

A. Perform installation and startup checks according to manufacturer's written instructions.

B. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Test grille opening when activated by detector, fire-alarm system, emergency-egress release, or self-opening mechanism as required. Reset grille-opening mechanism after successful test.

3.5 ADJUSTING

A. Adjust hardware and moving parts to function smoothly, so that grilles operate easily, free of warp, twist, or distortion.

1. Adjust exterior components to be weather resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.6 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-grille Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for grille operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, 7-day-per-week, emergency callback service.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling grilles.

END OF SECTION 08 33 26

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SECTION 08 34 73.13
METAL SOUND CONTROL DOOR ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes metal sound control door assemblies.

1.3 COORDINATION

A. Coordinate installation of anchorages for sound control door assemblies. Furnish setting drawings, templates, and directions for installing anchorages. Deliver sleeves, inserts, anchor bolts, and items with integral anchors to Project site in time for installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review procedures for coordinating frame and anchor installation with wall construction.
2. Review required field quality-control procedures.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product. Include sound ratings, construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.

B. Shop Drawings: For sound control door assemblies.

1. Include elevations of each door design.
2. Include details of sound control seals, door bottoms, and thresholds.
3. Include details of doors, including vertical- and horizontal-edge details and metal thicknesses.
4. Include frame details for each frame type, including dimensioned profiles and metal thicknesses.
5. Include locations of reinforcements and preparations for hardware.
6. Include details of each different wall opening condition.
7. Include details of anchorages, joints, field splices, and connections.
8. Include details of accessories.
9. Include details of moldings, removable stops, and glazing.
10. Include details of conduits and preparations for power, signal, and control systems.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish not less than 3 by 5 inches

1. Doors and Frames: Samples approximately 12 by 12 inches.

a. Doors: Include section of vertical-edge, top, and bottom construction; automatic door bottom or gasket; core construction; glazing; and hinge and other applied hardware reinforcement.
b. Frames: Include profile, corner joint, floor and wall anchors, and seals.

E. Schedule: Provide a schedule of sound control door assemblies prepared using same reference numbers for details and openings as those on Drawings. Coordinate with the Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, acoustical testing agency.

B. Product Certificates: For each type of sound control door assembly.

C. Product Test Reports: For each sound control door assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

E. Field quality-control reports.

F. Sample Warranty: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sound control door assemblies to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Acoustical Testing Agency Qualifications: An independent agency accredited as an acoustical laboratory according to the National Voluntary Laboratory Accreditation Program of NIST.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Avoid the use of nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of sound control door assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet sound rating requirements.
b. Faulty operation of sound seals.
c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sound Rating: Provide sound control door assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:

1. STC Rating: 45 as calculated by ASTM E413 when tested in an operable condition according to ASTM E90.

B. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.2 STEEL SOUND CONTROL DOORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Wenger, Acoustical Door; or a comparable product by one of the following:

1. Ceco Door; ASSA ABLOY.
2. Krieger Specialty Products Company.
3. Overly Door Company.

B. Source Limitations: Obtain steel sound control door assemblies, including doors, frames, sound control seals, hinges, thresholds, and other items essential for sound control, from single source from single manufacturer.

C. Doors: Flush-design sound control doors, thickness as required to provide STC rating, of seamless construction; with manufacturer's standard sound-retardant core as required to provide STC and fire rating indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges. Fabricate according to NAAMM-HMMA 865.

1. Exterior Doors: Fabricate from metallic-coated steel sheet 0.052-inch nominal thickness or thicker as required to provide STC rating indicated.
2. Interior Doors: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.048-inch nominal thickness or thicker as required to achieve STC rating indicated.
3. Core: Manufacturer's standard sound control core.
4. Loose Stops for Glazed Lites in Doors: Same material as face sheets.
5. Top and Bottom Channels: Closed with continuous channels of same material as face sheets, spot welded to face sheets not more than 6 inches o.c.
6. Hardware Reinforcement: Same material as face sheets.

D. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
3. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B, with G60 zinc (galvanized) or A40 zinc-iron-alloy (galvannealed) coating designation.
4. Glazing: As required by sound control door assembly manufacturer to comply with sound control and fire-rated-door labeling requirements.

E. Finishes:

1. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

    a. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2. Factory-Applied Paint Finish: Manufacturer's standard primer and finish coats, complying with SDI A250.3 for performance and acceptance criteria.

    a. Color and Gloss: Match Architect's sample .

2.3 SOUND CONTROL FRAMES

A. Frames: Fabricate sound control door frames with corners mitered, reinforced, and continuously welded the full depth and width of frame. Fabricate according to NAAMM-HMMA 865.

1. Weld frames according to NAAMM-HMMA 820.

2. Exterior Frames: Fabricate from metallic-coated steel sheet 0.079-inch nominal thickness or thicker as required to provide STC rating indicated.
3. Interior Frames: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.075-inch nominal thickness or thicker as required to provide STC rating indicated.
4. Hardware Reinforcement: Fabricate according to NAAMM-HMMA 865 of same material as face sheets.
5. Head Reinforcement: Metallic-coated steel channel or angle stiffener, 0.108-inch nominal thickness.
6. Jamb Anchors:

    a. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.064-inch nominal-thickness metallic-coated steel with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.156 inch thick.
    b. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.048-inch nominal-thickness uncoated steel unless otherwise indicated.
    c. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter, metallic-coated steel bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

7. Floor Anchors: Not less than 0.079-inch nominal-thickness metallic-coated steel, and as follows:

    a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
    b. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

8. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch-wide uncoated steel unless otherwise indicated.
9. Plaster Guards: Metallic-coated steel sheet, not less than 0.026 inch thick.

B. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
3. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B, with G60 zinc (galvanized) or A40 zinc-iron-alloy (galvannealed) coating designation.
4. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A153/A153M, Class B.
5. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A153/A153M or ASTM F2329.
6. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching sound control door frames of type indicated.
7. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.

C. Finishes:

1. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

a. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2. Factory-Applied Paint Finish: Manufacturer's standard primer and finish coats, complying with SDI A250.3 for performance and acceptance criteria.

a. Color and Gloss: Match Architect's sample.

2.4 HARDWARE

A. Sound Control Door Hardware: Manufacturer's standard sound control system, including head and jamb seals, door bottoms, cam-lift hinges, and thresholds, as required by testing to achieve STC and fire rating indicated.

1. Head and Jamb Seals: One of the following:

a. Neoprene Compression Seals: One-piece units consisting of closed-cell sponge neoprene seal held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.
b. Silicone Compression Seals: One-piece units consisting of silicone compression bulb and stabilizer flange; attached to door frame adhesively.
c. Magnetic Seals: One-piece units consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.

2. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.

a. Mounting: Mortised or semimortised into bottom of door or surface mounted on face of door as required by testing to achieve STC rating indicated.

3. Door Bottoms: Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door.
4. Cam-Lift Hinges: Full-mortise template type that raises door 1/2 inch when door is fully open; with hardened pin; fabricated from stainless steel.
5. Thresholds: Flat, smooth, unfluted type as recommended by manufacturer; fabricated from aluminum.

a. Finish: Clear anodic finish.

B. Other Hardware: Comply with requirements in Section 08 71 00 "Door Hardware."

2.5 SOUND CONTROL ACCESSORIES

A. Glazing: Manufacturers' standard factory-installed glazing.

B. Grout: Comply with ASTM C476, with a slump of not more than 4 inches as measured according to ASTM C143/C143M.

C. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

A. Steel Sound Control Door Fabrication: Sound control doors to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.

1. Comply with requirements in NFPA 80 for fire-rated and smoke control doors.
2. Seamless Edge Construction: Fabricate doors with faces joined at vertical edges by welding; welds shall be ground, filled, and dressed to make them invisible and to provide a smooth, flush surface.
3. Exterior Doors: Close top edges flush and seal joints against water penetration. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape.
4. Glazed Lites: Factory install glazed lites according to requirements of tested assembly to achieve STC rating indicated. Provide fixed stops and moldings welded on secure side of door.
5. Hardware Preparation: Factory prepare sound control doors to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.

    a. Reinforce doors to receive nontemplated mortised and surface-mounted door hardware.
    b. Locate door hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."

6. Tolerances: Fabricate doors to tolerances indicated in NAAMM-HMMA 865.

B. Sound Control Frame Fabrication: Fabricate sound control frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

1. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
4. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches in height.
        2) Three anchors per jamb from 60 to 90 inches in height.
        3) Four anchors per jamb from 90 to 96 inches in height.
        4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches, or fraction thereof, more than 96 inches in height.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches in height.
2) Four anchors per jamb from 60 to 90 inches in height.
3) Five anchors per jamb from 90 to 96 inches in height.
4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches, or fraction thereof, more than 96 inches in height.
5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

5. Head Reinforcement: For grouted frames more than 48 inches wide, weld continuous head reinforcement to back of frame at head full width of opening.
6. Hardware Preparation: Factory prepare sound control frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.

a. Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
b. Locate hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."

7. Plaster Guards: Weld guards to frame at back of hardware cutouts and glazing-stop screw and sound control seal preparations to close off interior of openings in frames to be grouted.
8. Tolerances: Fabricate frames to tolerances indicated in NAAMM-HMMA 865.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of sound control door frame connections before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace sound control door frames to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install sound control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.

B. Frames: Install sound control door frames in sizes and profiles indicated.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-rated openings, install frames according to NFPA 80.
    b. At openings requiring smoke and draft control, install frames according to NFPA 105.
    c. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, and dress; make splice smooth, flush, and invisible on exposed faces.
    d. Install sound control frames with removable glazing stops located on secure side of opening.
    e. Remove temporary braces only after frames or bucks have been properly set and secured.
    f. Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Apply corrosion-resistant coating to backs of frames to be filled with mortar, grout, and plaster containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Fully fill frames with mineral-fiber insulation.
4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
5. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting

construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.

7. Grouted Frames: Solidly fill space between frames and substrate with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
8. Installation Tolerances: Adjust sound control door frames for squareness, alignment, twist, and plumbness to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Doors: Fit sound control doors accurately in frames, within clearances indicated below. Shim as necessary.

1. Non-Fire-Rated Doors: Fit non-fire-rated doors accurately in frames with the following clearances:

    a. Jambs: 1/8 inch.
    b. Head with Butt Hinges: 1/8 inch.
    c. Head with Cam-Lift Hinges: As required by manufacturer, but not more than 3/8 inch.
    d. Sill: Manufacturer's standard.
    e. Between Edges of Pairs of Doors: 1/8 inch.

2. Fire-Rated Doors: Install fire-rated doors with clearances according to NFPA 80.

D. Sound Control Seals: Where seals have been factory prefit and preinstalled and subsequently removed for shipping, reinstall seals and adjust according to manufacturer's written instructions.

E. Cam-Lift Hinges: Install hinges according to manufacturer's written instructions.

F. Thresholds: Set thresholds in full bed of sealant complying with requirements in Section 07 92 00 "Joint Sealants."

G. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with sound control door assembly manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Perform testing for verification that assembly complies with STC rating requirements.

1. Acoustical testing and inspecting agency shall select one sound control door(s) at random from sound control door assemblies that are completely installed for testing.
2. Field tests shall be conducted according to ASTM E336, with results calculated according to ASTM E413. Acceptable field NIC values shall be within 5 dB of laboratory STC values.
3. Inspection Report: Acoustical testing agency shall submit report in writing to Architect and Contractor within 24 hours after testing.
4. If tested door fails, replace or rework all sound control door assemblies to bring them into compliance at Contractor's expense.

    a. Additional testing and inspecting at Contractor's expense will be performed to determine if replaced or additional work complies with specified requirements.

C. Prepare test and inspection reports.

3.5 ADJUSTING AND CLEANING

A. Final Adjustments: Check and adjust seals, door bottoms, and other sound control hardware items right before final inspection. Leave work in complete and proper operating condition.

B. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.

1. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.

C. Grouted Frames: Clean grout off sound control door frames immediately after installation.

D. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible, rust-inhibitive, air-drying primer.

E. Metallic-Coated Surfaces: Clean abraded areas of doors and repair with galvanizing repair paint according to manufacturer's written instructions.

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SECTION 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior storefront.
2. Entrance doors and frames.

1.3 SUBMITTALS

A. Product Approval: Submit current Product Approval documentation in accordance with the Florida Building Code.

B. Engineering Responsibility: Prepare engineering data, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project as prepared by a professional engineer registered in the state of Florida.

C. Testing and Labeling: Comply with the Building Code. Submit manufacturer’s certification indicating compliance.

D. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

E. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.

1. Engineering Responsibility: Prepare engineering data for storefront and entrance systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project as prepared by a professional engineer registered in the state of Florida.

    a. Include structural analysis data signed and sealed by professional engineer registered in the state of Florida responsible for their preparation.
    b. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.

c. Include all drawings and installation details required to insure the elements installed on this Project will be installed in the same manner as they were tested and approved.

F. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

G. Samples for Verification: Of exposed finish selected in manufacturer's standard sizes.

H. Samples: For the following.

1. Aluminum Framing:

a. Samples for Verification: Of exposed metal finish selected in manufacturer's standard sizes.

2. Glass: Glass products, in the form of 12-inch-square Samples for each type of glass indicated.

I. Test Reports: Provide certified test reports indicating compliance with the Building Code.

J. Field Test Reports: Field quality-control test reports.

K. Warranties: Warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Experienced Installers skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five (5) years.

1. Engineering Responsibility: Preparation of data for storefront systems including the following:

a. Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
b. Shop Drawings, pre-construction testing program development, and comprehensive engineering analysis by a qualified professional engineer.

B. Test Reports: Provide test reports from AAMA accredited laboratories certifying the performance as specified.

1. Test reports shall be accompanied by the window manufacturer’s letter of certification, stating the tested window meets or exceeds the referenced criteria for the appropriate ANSI/AAMA/NWWDA 101/I.S.2/NAFS-02 window type.

C. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

D. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

E. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review required testing and inspecting procedures.

F. Source Limitations for Glass: Obtain glass from one source from a single manufacturer for each glass type.

G. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Environmental Limitations for Glass and Glazing: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 degrees F.

1.7 WARRANTY

A. Manufacturer’s Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration created by wind and thermal and structural movements.
   c. Deterioration of metals and other materials beyond normal weathering.
   d. Water penetration through fixed glazing and framing areas.
   e. Failure of operating components.

2. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

B. Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 10 years from date of Final Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Provide exterior opening capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified.

B. All exterior openings (other than EHPA) shall meet the following minimum requirements:

1. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone indicated.

a. Large-Missile Test: For glazing located within 30 feet of grade.
b. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.

2. Openings in EHPA shall meet enhanced Performance Requirements as listed below.

C. Structural design of systems will be the responsibility of the manufacturer and is to be designed to comply with the Florida Building Code along with additional wind loading as follows:

1. Code Conformance: Design of system shall comply with the requirements of ASCE-7, latest edition adopted by D.O.E. except as modified by this section.

D. EHPA areas shall be designed for wind loads in accordance with ASCE-7, latest edition adopted by D.O.E., Category 4 (Essential Buildings). See architectural drawings for the building(s) required to comply with the EHPA requirement.

1. EHPA Building Envelope shall comply with SBCCI/SSTD-12 for large missile impact criteria. Refer to architectural drawings for building envelope path and location.

E. Codes Compliance: Comply with requirements of the Florida Building Code for wind and impact resistance.

F. Delegated Design: Engage a qualified professional engineer, to design aluminum-framed entrances and storefronts.

G. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

H. Structural Loads:

1. Wind Loads: As indicated.

I. Uniform Load Structural: A minimum static air pressure difference of 105 psf shall be applied in the positive and negative direction in accordance with ASTM E330. The unit shall be evaluated after each load with permanent set not to exceed 0.2% of span length.

J. Deflection: Maximum allowable deflection in any member when tested in accordance with ASTM E 330 with allowable stress in accordance with AA Specifications for Aluminum Structures.

1. Without Horizontals: L/175 maximum.
2. With Horizontals: L/175 or L/240 + 1/4" for spans greater than 13'-6" (but less than 40'-0".

K. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283 at a minimum size of 60”x99”. Air infiltration rate shall not exceed 0.10 cfm/ft2 at a static air pressure differential of 6.24 psf.

L. Thermal Movement: Provide for thermal movement caused by 180 degrees F. surface temperature, without causing buckling stresses on glass, joint seal failure, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or detrimental effects.

M. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas as a system shall have U-factor of not more than glazing see section 08 80 00 “Glazing.”
2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas as a system shall have SHGC of not more than glazing see section 08 80 00 “Glazing.”

N. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone indicated for enhanced protection.

1. Large-Missile Test: For glazing located within 30 feet of grade.
2. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.

O. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.

b. Low Exterior Ambient-Air Temperature: 0 deg F.
c. Interior Ambient-Air Temperature: 75 deg F.

2.2 MANUFACTURER

A. Basis of Design Manufacturer; YKK AP America, or subject to compliance with requirements a comparable product by one of the following:

1. EFCO, Corporation.
2. Kawneer an Alcoa Company.

2.3 EXTERIOR FRAMES - NON-IMPACT

A. Model and Manufacturer – Basis of Design: YKK AP America, Model YES45FI, FPA# 12926.

1. Exterior Framing Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.
4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

2.4 EXTERIOR FRAMES - IMPACT

A. Model and Manufacturer – Basis of Design: YKK AP America, Model YHS50FI, FPA# 14218.

1. Exterior Framing Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.
4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

2.5 EXTERIOR ENTRANCES - NON-IMPACT

A. Model and Manufacturer – Basis of Design: YKK AP America, Model 35, FPA# 12892, (medium stile) Swing Doors.

1. Finish: Clear Anodized.

2.6 EXTERIOR ENTRANCES - IMPACT

A. Model and Manufacturer – Basis of Design: YKK AP America, Model 35H, FPA# 16554, (medium stile) Swing Doors.

1. Finish: Clear Anodized.

2.7 INTERIOR FRAMES

A. Model and Manufacturer – Basis of Design: YES 40 FS, YKK AP America.

1. Finish: Clear Anodized.

2.8 INTERIOR ENTRANCES

A. Model and Manufacturer – Basis of Design: Model 35 (medium stile).

1. Finish: Clear Anodized.

2.9 GLAZING

A. Refer to Section 08 80 00 “Glazing.”

2.10 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Bars, Rods, and Wire: ASTM B 211.
5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement: Complying with ASTM A 36 for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 for hot-rolled sheet and strip.

C. Glazing Gaskets: As required to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.

D. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

E. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

F. Compression Glazing Strips and Weather-Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when aluminum window is closed.

1. Weather-Stripping Material: Elastomeric cellular preformed gaskets complying with ASTM C 509.
2. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864

3. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/NWWDA 101/I.S.2.

2.11 COMPONENTS

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Reinforce members as required to retain fastener threads.
2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.

B. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

2.12 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware for each entrance door to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Refer to Section 08 71 00, Door Hardware and the following.

a. Weather Stripping: Manufacturer's standard replaceable components.
b. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
c. Silencers: BHMA A156.16, Grade 1.

B. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.13 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

1. Fabricate components for screw-spline (concealed fastener) frame construction.
2. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
3. Prepare components to receive concealed fasteners and anchor and connection devices.
4. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

B. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."

D. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

2.14 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of glazing systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 ELECTROLYSIS PREVENTION

A. Electrolysis Prevention: paint dissimilar metals, except stainless steel, white, bronze and/or solid zinc, with one heavy brush or spray coat of zinc-chromate primer and one coat of aluminum paint; or paint with one heavy brush coat of alkali-resistant bituminous paint; or separate from aluminum by heavy coat of mastic caulking compound or non-absorptive tape or gasket. Include dissimilar metals used in locations where drainage from them passes over aluminum.

3.3 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing glazing systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints. Seal joints watertight.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install the system plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.

D. Install glazing to comply with requirements of Section 08 80 00 Glazing, unless otherwise indicated.

E. Install perimeter sealant to comply with requirements of Section 07 92 00 Joint Sealants, unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

a. Perform a minimum of three tests in areas as directed by Architect.
b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.

2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

a. Perform a minimum of three tests in areas as directed by Architect.
b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.

3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.

C. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.

1. Test a minimum of two six areas on each building facade.
2. Repair installation areas damaged by testing.

D. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure glazing systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 41 13

SECTION 08 51 13
ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Aluminum widows.

1.3 SUBMITTALS

A. Product Approval: Submit current Product Approval documentation in accordance with the Florida Building Code.

B. Engineering Responsibility: Prepare engineering data, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project as prepared by a professional engineer registered in the state of Florida.

C. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

D. Shop Drawings showing fabrication and installation of each type of window required including information not fully detailed in manufacturer's standard Product Data and the following:

1. Layout and installation details, including anchors.
2. Elevations at 1/4 inch = 1 foot scale and typical window unit elevations at 3/4 inch = 1 foot scale.
3. Full-size section details of typical composite members, including reinforcement and stiffeners.
4. Manufacturers installation instructions for each specific window opening type.
5. Hardware, including operators.
6. Glazing details.
7. Accessories.
8. Provide analysis data signed and sealed by a qualified professional engineer registered in the state of Florida and responsible for their preparation.
9. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.

E. Pre-Installation Minutes: Submit pre-installation conference meeting minutes.

F. Samples for initial color selection on 12 inch long sections of window members. Where finishes involve normal color variations, include sample sets showing the full range of variations expected.

G. Samples for Verification: The Architect reserves the right to require additional samples that show fabrication techniques, workmanship, and design of hardware and accessories.

H. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

I. Qualification Data: For qualified Installer and testing agency.

J. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for Aluminum Windows, indicating compliance with performance requirements.

K. Field quality-control reports.

L. Maintenance Data: For Aluminum Windows systems to include in maintenance manuals.

M. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Installers Qualifications: Engage an experienced Installer who has completed installation of aluminum windows similar in material, design and extent to those required for this project and with a record of successful in-service performance.

B. Provide test reports from AAMA accredited laboratories certifying the performance.

1. Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to ARCHITECT'S satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the work.
2. Test reports shall be accompanied by the window manufacturer’s letter of certification, stating the tested window meets or exceeds the referenced criteria for the appropriate AAMA/NWWDA 101/I.S.2-97 window type.

C. Professional Engineer Qualifications: The engineer shall be a professional engineer registered in the state of Florida and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of Aluminum Windows that are similar to those indicated for this Project in material, design, and extent.

D. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."

E. Source Limitations for Aluminum Windows: Obtain from single source from single manufacturer.

F. Pre-installation Meeting: Meet at the project site with the Contractor, installer, manufacturer and Architect before starting installation of aluminum windows. Record meeting minutes and submit to the Architect for review.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.6 WARRANTIES

A. Total Window System

1. The responsible contractor shall assume full responsibility and warrant for one year the satisfactory performance of the total window installation which includes that of the windows, hardware, glass (including insulated units), glazing, anchorage and setting system, sealing, flashing, etc., as it relates to air, water, and structural adequacy as called for in the specifications and approved shop drawings.
2. Any deficiencies due to such elements not meeting the specifications shall be corrected by the responsible contractor at his expense during the warranty period.

B. General Warranty: The special warranty specified in this article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

C. Special Warranty: Submit a written warranty signed by aluminum window manufacturer agreeing to repair or replace window components that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

D. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.

1. Faulty operation of sash and hardware.
2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

E. Warranty Period: 5 years after date of substantial completion.

F. Warranty Period for Metal Finishes and Glass: 10 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Provide exterior opening capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified.

B. All exterior openings (other than EHPA) shall meet the following minimum requirements:

1. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone indicated.

a. Large-Missile Test: For glazing located within 30 feet of grade.
b. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.

2. Openings in EHPA shall meet enhanced Performance Requirements as listed below.

C. Structural design of systems will be the responsibility of the manufacturer and is to be designed to comply with the Florida Building Code along with additional wind loading as follows:

1. Code Conformance: Design of system shall comply with the requirements of ASCE-7, latest edition adopted by D.O.E. except as modified by this section.

D. EHPA areas shall be designed for wind loads in accordance with ASCE-7, latest edition adopted by D.O.E., Category 4 (Essential Buildings). See architectural drawings for the building(s) required to comply with the EHPA requirement.

1. EHPA Building Envelope shall comply with SBCCI/SSTD-12 for large missile impact criteria. Refer to architectural drawings for building envelope path and location.

E. Codes Compliance: Comply with requirements of the Florida Building Code for wind and impact resistance.

F. Delegated Design: Engage a qualified professional engineer, to design aluminum windows.

G. Structural Loads:

1. Wind Loads: As indicated.

H. Test Units

1. Air, water, and structural test unit shall conform to requirements set forth in AAMA/NWWDA 101/I.S.2-97.

I. Test Procedures and Performances

1. Windows shall conform to all AAMA/NWWDA 101/I.S.2-97 requirements. In addition, the following specific performance requirements shall be met.

2. Air Infiltration Test

a. With ventilators closed and locked, test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf.
b. Air infiltration shall not exceed .10 cfm per foot of crack.

3. Water Resistance Test

a. With ventilators closed and locked, test unit in accordance with ASTM E 331/ASTM E 547 at a static air pressure difference of 12 psf.
b. There shall be no uncontrolled water leakage.

4. Uniform Load Deflection Test

a. With ventilators closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference of 65 psf positive and negative pressure.
b. No member shall deflect over L/175 of its span.

5. Uniform Load Structural Test

a. With ventilators closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference of 97.5 psf, both positive and negative.
b. At conclusion of test there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, nor any other damage that would cause the window to be inoperable.

6. Condensation Resistance Test

a. With ventilators closed and locked, test unit in accordance with AAMA 1503.1.
b. Condensation Resistance Factor (CRF) shall not be less than 49.

7. Life Cycle Testing: Test in accordance with AAMA 910. There shall be no damage to fasteners, hardware parts, support arms, activating mechanisms, or any other damage that would cause the window to be inoperable. Air infiltration and water resistance tests shall not exceed specified requirements.
8. Thermal Movements: Provide aluminum windows, including anchorage, that accommodate thermal movements of units resulting from the following maximum change (range) in ambient and surface temperatures without buckling, distortion, opening of joints, failure of joint sealants, damaging loads and stresses on glazing and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime-sky heat loss. 1)

a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.

9. Thermal Transmittance Test

a. Conductive thermal transmittance (U-Factor) shall not be more than .60_ BTU/hr•tt2•°F.
b. Solar Heat Gain Coefficient: No greater than 0.25 as determined according to NFRC 200.

2.2 ALUMINUM WINDOWS

A. Single-Source Responsibility: Obtain aluminum windows from one source and by a single manufacturer.

B. Casement Window Model and Manufacturer – Basis of Design: YKK AP America, Model YOW225, FPA# for Casement windows: 16313.

1. Or a comparable product by one of the following:

a. EFCO, Corporation.
b. Kawneer and Alcoa Company.

2. Finish: Clear Anodized.

C. Sliding Window; subject to compliance with requirements provide product by one of the following:

1. YKK AP America.
2. EFCO, Corporation.
3. Kawneer and Alcoa Company.

D. Finish: Clear Anodized.

2.3 GLAZING

A. Refer to Section 08 80 00 “Glazing.”

2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Bars, Rods, and Wire: ASTM B 211.
5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Glazing Gaskets: As required to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.

C. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

D. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

E. Compression Glazing Strips and Weather-Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when aluminum window is closed.

1. Weather-Stripping Material: Elastomeric cellular preformed gaskets complying with ASTM C 509.
2. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864
3. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/NWWDA 101/I.S.2.

2.5 COMPONENTS

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Reinforce members as required to retain fastener threads.
2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.

B. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

2.6 GLAZING

A. Glass: All glass shall be factory installed. Field-glazed of window units not allowed.

2.7 HARDWARE

A. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.

B. Casement Window Hardware:

1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested according to ASTM E 405, Method A.

a. Type and Style: As selected by Architect from manufacturer's full range of types and styles.

2. Hinges: Non-friction type, not less than two per sash.
3. Lock: Lift-type throw, cam-action lock with keeper.
4. Locking handles shall be cam type and manufactured from a white bronze alloy with a US25D brushed finish.
5. Limit Devices: Provide concealed support arms with adjustable, limited, hold-open limit devices designed to restrict sash or ventilator opening for first floor windows.

a. Safety Devices: Limit clear opening to exterior face of exterior veneer brick for ventilation; with custodial key release. 3-inches maximum.

C. Horizontal-Sliding Window Hardware:

1. Sill Cap/Track: Manufacturer's standard of dimensions and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Provide key-operated custodial locks.
3. Roller Assemblies: Low-friction design.

2.8 ACCESSORIES

A. General: Provide manufacturer’s standard accessories that comply with indicated standards, unless otherwise indicated.

B. Sill treatment shall be by an extruded sill receptor or 0.062-inch thick sill flashing finished to match windows. Sill profile shall be properly end dammed and sealed to the substrate.

C. Ventilator

1. All vent extrusions shall be tubular.

2. Each corner shall be mitered, reinforced with an extruded corner key, hydraulically crimped, and "cold welded" with epoxy adhesive.
3. Each vent shall be pressure equalized utilizing two rows of weather stripping installed in specifically designed dovetail grooves in the extrusion.
4. The vent shall present a flush appearance with the exterior and interior of the main frame when in the closed position.

D. Muntins

1. Muntins shall be shop attached (non-removable), exterior grid designed to replicate steel, putty-glazed sash.

E. Screens

1. Screen frames shall be extruded aluminum.
2. Screen mounting holes in the window frame shall be factory drilled.
3. Screen mesh shall be stainless steel.

2.9 FABRICATION

A. General: Manufacturer's standard fabrication that complies with the indicated standards. Include a complete system for assembling components and anchoring windows.

1. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.
2. Fabricate aluminum windows, in sizes indicated.

2.10 ALUMINUM FINISH

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.

1. Do not install damaged components.
2. Seal joints watertight.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install glazing as specified Division 08 Section "Glazing."

E. Install sealants as specified in Division 07 Section "Joint Sealants."

F. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

G. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Connections: Connect automatic operators to building electrical system.

3.3 INCLEMENT WEATHER PROTECTION/TEMPORARY INSTALLATION

A. No temporary installations of the window shall be done. The window shall be installed and permanently fastened in the initial installation.

3.4 ADJUSTING

A. Adjust operating ventilators, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
2. Air-Infiltration Testing:

a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.

b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water-Resistance Testing:

a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
5. Test Reports: Prepared according to AAMA 502.

C. Windows will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 PROTECTION AND CLEANING

A. All windows shall use positive graphic identification showing that there is glazing in the frame while the window is being installed. Remove graphic identification when the window is cleaned.

B. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

C. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

D. Clean glass immediately after installation. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

E. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08 51 13

SECTION 08 56 19
TICKET WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide labor, materials, and equipment necessary for the complete installation of pass through windows as specified herein and as indicated on the drawings.

1.3 SUBMITTALS

A. Product Approval: Submit current Product Approval documentation in accordance with the Florida Building Code.

B. Shop Drawings, including:

1. Construction details and fabrication methods
2. Profiles and dimensions of individual components
3. Data on hardware, accessories, and finishes
4. Recommendations for maintenance and cleaning of exterior surfaces

C. Shop drawings: Include information not fully detailed in manufacturer's standard product data and the following:

1. Layout and installation details, including anchors
2. Typical window unit elevations at 3/4-inch scale.
3. Full-size section details of typical composite members, including reinforcement
4. Glazing details
5. Accessories

D. Submit warranty as specified herein.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed installation of ticket windows similar in design and extent to those required for the project and whose work has resulted in construction with a record of successful in-service performance.

B. Standards: Requirements for aluminum windows, terminology and standards of performance, and fabrication workmanship are those specified and recommended in AAMA 101 and applicable general recommendations published by AAMA.

1. Refer to Structural Drawings for wind velocity.

1.5 PROJECT CONDITIONS

A. Field Measurements: Check actual window openings by accurate field measurement before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

1.6 WARRANTY

A. Submit a written warranty, agreeing to repair or replace window units that fail in materials or workmanship within the specified warranty period. Failures include but are not limited to:

1. Structural failures including excessive deflection, excessive leakage, or air infiltration.
2. Faulty operation of sash and hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Warranty Period: Five (5) years from the Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Provide exterior opening capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified.

B. Structural design of systems will be the responsibility of the manufacturer and is to be designed to comply with the Florida Building Code along with additional wind loading as follows:

1. Code Conformance: Design of system shall comply with the requirements of ASCE-7, latest edition adopted by D.O.E. except as modified by this section.

C. All exterior openings (other than EHPA) shall meet the following minimum requirements:

1. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone indicated.

a. Large-Missile Test: For glazing located within 30 feet of grade.
b. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.

2. Openings in EHPA shall meet enhanced Performance Requirements as listed below.

D. EHPA areas shall be designed for wind loads in accordance with ASCE-7, latest edition adopted by D.O.E., Category 4 (Essential Buildings). See architectural drawings for the building(s) required to comply with the EHPA requirement.

1. EHPA Building Envelope shall comply with SBCCI/SSTD-12 for large missile impact criteria. Refer to architectural drawings for building envelope path and location.

E. Codes Compliance: Comply with requirements of the Florida Building Code for wind and impact resistance.

F. Wind Loads: As indicated on Drawings.

G. Glazing Systems: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

H. Structural Loads:

1. Wind Loads: As indicated.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

J. Thermal Performance: When tested in accordance with AAMA 507, AAMA 1503 and NFRC 100:

1. Match Window Glazing See section 08 80 00 “Glazing.”

2.2 ACCEPTABLE MANUFACTURERS

A. Basis of Design product and Manufacturer: Ready Access, Inc. Model 603, or subject to compliance with requirements a comparable product by one of the following:

1. Easi-Serve Products, Inc.

B. Glazing Types:

1. Interior Locations: 1-1/4” thick, Level 3 Bullet Resistance with Lexan Speak Thru.

2. Exterior Locations: 3/4” thick, Level 1 Bullet Resistance with Stainless Steel, weather tight, non-electric Speak Thru device.

2.3 PRODUCTS/MATERIALS

A. Aluminum Extrusions: Provide alloy and temper recommended by the window manufacturer for the strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength and not less than 0.062 inch thick.

B. Transaction Counter: Stainless steel, 12 inches deep by width of security window, with integral deal tray centered in opening.

C. Speaking Apertures: Weathertight Non-electrical, fabricated from stainless steel, designed to allow passage of speech at normal speaking volume without distortion.

1. Shape: Circular.

2.4 HARDWARE

A. Manufacturer's standard for unit provided including deal tray closure and draft free talkthrough.

2.5 FABRICATION

A. Pre-glazed Fabrication: Pre-glaze window units at the factory. Comply with glass and glazing requirements of Section 08 80 00 "Glazing," and of these specifications and AAMA 101.

B. All frame and vent joints shall be factory sealed with sealant conforming to AAMA 800.

C. Water Control: compression gaskets on vent interior shall utilize pressure equalization and shall allow water to drain by gravity.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect openings before beginning installation. Verify that rough or masonry opening is correct and the sill plate is level.

3.2 INSTALLATION

A. Set sill members and other members in a bed of compound or with joint fillers or gaskets, to provide weathertight construction. Refer to the Section 07 92 00 "Joint Sealants."

B. Coordinate installation with wall flashings and other components of the work.

C. Provide all items and accessories as required for a complete and watertight installation. Provide all miscellaneous accessories and trim and flashing as required.

D. Install per manufacturer's recommendations.

3.3 CLEANING

A. Clean aluminum surfaces promptly after installation of windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.

B. Clean glass promptly after installation of windows.

3.4 PROTECTION

A. Initiate and maintain protection and other precautions required through the remainder of the construction period, to ensure that, except for normal weathering, window units will be free of damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 56 19

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SECTION 08 56 59
AUTOMATIC COUNTER WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide labor, materials, and equipment necessary for the complete installation of pass through windows as specified herein and as indicated on the drawings.

B. Section includes:

1. Automatic Counter Windows.

1.3 SUBMITTALS

A. Submit the following in accordance with Division 01 requirements.

1. Product data, including:

   a. Construction details and fabrication methods
   b. Profiles and dimensions of individual components
   c. Data on hardware, accessories, and finishes
   d. Recommendations for maintenance and cleaning of exterior surfaces

2. Shop drawings: Include information not fully detailed in manufacturer's standard product data and the following:

   a. Layout and installation details, including anchors
   b. Typical window unit elevations at 3/4-inch scale.
   c. Full-size section details of typical composite members, including reinforcement
   d. Hardware including operators
   e. Glazing details
   f. Accessories
   g. Wiring Diagrams.
   h. Shop drawings shall indicate coordination with building power.

B. Submit warranty as specified herein.

1.4 CLOSEOUT SUBMITTALS

A. Provide literature for inclusion in the Operation and Maintenance manuals indicating periodic maintenance, scheduled maintenance, necessary interim adjustments and lubrication, and other maintenance as requiem by the Manufacturer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed installation of pass through windows similar in design and extent to those required for the project and whose work has resulted in construction with a record of successful in-service performance.

1.6 PROJECT CONDITIONS

A. Field Measurements: Check actual window openings by accurate field measurement before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

1.7 WARRANTY

A. Submit a written warranty, agreeing to repair or replace window units that fail in materials or workmanship within the specified warranty period. Failures include but are not limited to:

1. Structural failures including excessive deflection, excessive leakage, or air infiltration.

2. Faulty operation of sash and hardware.

3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Warranty Period: Five (5) years from the Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Single-operable Leaf sliding window.

1. Basis of Design: Product and Manufacturer; 600 Series, Ready Access, Inc.

a. Size as Indicated.
b. Finish: Clear Anodized Aluminum

B. Other Manufacturer offering products which may be incorporated into the work are as follows:

1. SS-series Quick Serve Corp.

C. Automatic Operation: Operation to open and close automatically.

2.2 CONTROLLER

A. Manufacturers Standard Controller to accommodate operation as described.

1. Controller shall have the following minimum components:

a. Power Lamp This lamp indicates that the power rocker switch is on and the controller is receiving power.
b. Motor Run Lamp The “MOTOR RUN” lamp indicates that power is being applied to the motor. When the door is opening, lamp will illuminate green. When the door is closing, the lamp will illuminate red. The lamp also allows for the diagnostic checking of the motor and motor wiring. To test, turn the power “OFF” at the rocker switch and manually open and close the door. This will cause the lamp to illuminate either green or red. The “POWER” lamp must illuminate during both operations. If neither of these lamps illuminate during any of the processes, proceed to the “Troubleshooting” section.
c. Beam Break Lamp This lamp indicates that the electric eye beam or presence sensor beam has been broken and/or the “CLOSE DELAY” timer is still timing out.
d. Close Detect Lamp: This lamp is red and indicates that a “CLOSE” sequence has been initiated. It will always light during a door closure and will go out just before the door contacts the frame. When the lamp is out, the automatic reverse feature is disabled.
e. Current Detect Lamp: This lamp is red and indicates an overload has been detected. This lamp may light on opening but is automatically disabled. The lamp will come on when the door is fully closed or when an obstruction has been encountered
f. Beam Test Switch: Pressing the “BEAM TEST” button once will test the operations of the door without using the electric eye or presence sensor. To test, the operator should not be in the path of the light beam or presence sensor. Standing in the light beam while pressing the button will put the window into a test mode. This will make the window continuously operate (open and close) automatically. You must turn the power off and back on to reset the window.
g. Close Delay Switch: Pressing this button will toggle the length of time that the door remains open between 1.5 and 3.0 seconds before closing.

2.3 PRODUCTS/MATERIALS

A. Aluminum Extrusions: Provide alloy and temper recommended by the window manufacturer for the strength, corrosion resistance, and application of required finish.

B. Glass Assembly: 3/4-inch thick Polycarbonate with Level-1 Bullet Resistance.

2.4 FABRICATION

A. Pre-glazed Fabrication: Pre-glaze window units at the factory. Comply with glass and glazing requirements AAMA 101.

B. All frame and vent joints shall be factory sealed with sealant conforming to AAMA 800.

2.5 FINISHES

A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes. Apply on clean extrusions free from surface blemishes or scratches.

1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect openings before beginning installation. Verify that rough or masonry opening is correct and the sill plate is level.

B. Verify power connection place for connection to automatic windows.

3.2 INSTALLATION

A. Set sill members and other members in a bed of compound or with joint fillers or gaskets, as shown, to provide weathertight construction. Refer to the "Joint Sealer" sections of Division 7 for compounds, fillers, and gaskets to be installed concurrently with window units. Coordinate installation with wall flashings and other components of the work.

1. Compounds, joint fillers, and gaskets to be installed after installation of window units are specified as work in another section in Division 7.

B. Provide all items and accessories as required for a complete and watertight installation in every respect, whether or not indicated on the drawings or specifications. Provide all miscellaneous accessories and trim and panning flashing as required whether or not indicated on the drawings or specified herein.

C. Install per manufacturer’s recommendations.

1. Compounds, joint fillers, and gaskets to be installed after installation of window units are specified as work in another section in Division 7.

3.3 CLEANING

A. Clean aluminum surfaces promptly after installation of windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.

B. Clean glass of preglazed units promptly after installation of windows.

3.4 DEMONSTRATION AND ADJUSTMENT

A. Manufacturer shall make final adjustments ot ensure operation is smooth and as intended. Manufacturer shall instruct building personnel on operation of and adjustment for main maintaining operation of windows,

3.5 PROTECTION

A. Initiate and maintain protection and other precautions required through the remainder of the construction period, to ensure that, except for normal weathering, window units will be free of damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 56 59

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SECTION 08 56 73
SOUND RETARDANT WINDOWS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes sound control windows with STC ratings of 46.

1.3 QUALITY ASSURANCE

A. All testing shall be performed by an independent architectural testing laboratory accredited by the American Architectural Manufactures Association (AAMA), the National Voluntary Laboratory Accreditation Program (NVLAP) and the International Conference of Building Officials (ICBO) and such other accreditation as may be required by state of local building regulations.

B. The manufacturer shall provide the architect and Owner a notarized affidavit of compliance certifying that the doors furnished for this project are identical in every aspect of design, component parts (including sealants and the application thereof, reinforcing members, etc.) and fabrication techniques as the doors tested in the laboratory for which test reports have been furnished.

1.4 SUBMITTALS

A. Window manufacturer shall supply test reports from an AAMA- and NVLAP- accredited laboratory certifying compliance with performance specifications for each type of window supplied for this project.

B. Window manufacturer shall supply product data for each type of window required, including:

1. Construction details and fabrication methods.
2. Data on hardware and accessories.
3. Recommendations for maintenance and cleaning of exterior surfaces.

C. Before proceeding with the manufacture of windows, the window contractor shall submit complete shop drawings with installation details for the Architect’s approval. These drawings shall also show window elevations, details of all window sections, collateral materials, details of anchorage, associated hardware.

D. Window manufacturer shall submit three 3 samples of finish.

E. Window manufacturer shall submit a copy of the product warranty to be applied to this project.

1.5 WARRANTY

A. The manufacturer shall warrant the product against material defects or defects in manufacturing. If a defect is discovered and brought to the attention of the Manufacturer, the defect will be corrected at no cost to the Owner. Warranty shall not be pro-rated. Warranties requiring the Owner to return windows to the factory for repair or replacement shall not be accepted.

1. Window warranty: Ten 10 years against defects in material or workmanship under normal use.
2. Finish warranty: Ten 10 years against chipping, peeling, cracking, chalking, or fading.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sound Transmission

1. Sound Transmission Class (STC). When tested in accordance with ASTM E1425, window shall perform to a minimum STC-46. Testing shall be performed in a NVLAP Certified Test Laboratory.

2.2 MANUFACTURER

A. Basis of Design Product and Manufacturer; St. Cloud Window, Inc, Model as indicated below:

1. SCW960 – Fixed Lite.

2.3 MATERIALS

A. Aluminum Extrusions

1. Shall be accurately extruded aluminum alloy 6063-T6.
2. All sash, screen, and frame members shall have a minimum wall thickness of 0.062.
3. Sill frame shall be constructed of extruded tubular shapes and shall include an aluminum closed weep system to prevent accumulation of water in sill. Tubular shapes that are formed by snapped-on or slide-together extrusions shall not be accepted.
4. Exterior and interior frame sill shall have a minimum slope of 5 degrees.

B. Thermal Barrier

1. All frame members shall be thermally broken by an extruded PVC thermal-barrier which shall provide complete metal-to-metal separation between the inner and outer frame members of not less than ¼". The thermal-barrier shall interlock to both halves of the frame, securely locking them together, though not inhibiting the expansion and contraction of either part. A bead of sealant shall be applied to the complete perimeter of the window to seal the joints between the frame and thermal-barrier. A poured and de-bridged thermal-barrier will not be accepted.

C. Gaskets

1. All corner joints of the master frame shall have neoprene gaskets to insure a weather-tight seal.

D. Weather-stripping

1. All sashes shall be double weather-stripped with 100% woven pile and Mylar center fins conforming to AAMA 701/702. Weatherstripping to be secured within extruded shapes of the aluminum profiles to prevent movement. Surface applied weather strip shall not be accepted.

E. Hardware

1. All interior sash rails shall have a spring-loaded extruded metal self-latching lock.
2. Sash Rollers: All horizontal rolling window sashes shall have a minimum of two sash rollers per sash made of Delrin material operating on a stainless-steel axle. Rollers shall be recessed into the bottom sash rail so as not to protrude beyond the sash extrusion or weather-strip. Stainless steel rollers will not be accepted.

F. Glazing: Refer to Section 08 80 00 “Glazing.”

1. All operable sashes shall be marine-glazed with reusable flexible glazing vinyl.
2. All fixed glass to be set against sealant tape and wet sealed with a cap bead at the exterior. Interior lite to be dry sealed with a push-in glazing gasket.

    1. Acoustic Liner.

3. Each master frame shall have an acoustic liner of open-cell absorption foam covered by a perforated aluminum cover. Acoustic liner shall surround the entire inside perimeter of the intermediate frame but shall not prevent or inhibit the drainage of moisture across the sill of the master frame. The open area of perforation shall be not less than 18 percent. Absorption materials within the acoustic liner or master frame that are comprised of cellulose or other organic materials shall not be accepted.

2.4 FABRICATION

A. Window shall consist of two separate frames permanently interlocked by a rigid vinyl thermal-barrier. All joints of the frame and sash shall be butt type, secured by means of thread-cutting type screws anchored into screw ports which shall be an integral part of frame members. All corner joints shall be joined neatly in a manner to provide weather-tight connection. Sash corners to be internally sealed. All sharp milled edges and corners of sash and screen frame shall be de-burred and made smooth. The meeting rail shall be of tubular construction, double weather-stripped and interlocked when in a closed position. Window unit is to be constructed in a manner that will facilitate the replacement of worn or damaged parts, hardware, or weather-strip.

2.5 FINISH

A. Anodized Finish: Class I (etched and anodized to 0.7 mil), conforming to AAMA 611-98

1. Color: As selected by Architect from Manufacturers full range.

PART 3 - ERECTION

3.1 INSTALLATION

A. All window and related window components shall be installed in accordance with requirements of the Owner and the approved shop drawings of the Manufacturer. Installation shall be by a contractor who is experienced and who shall document at least one other projects of similar nature and scope for which the window products were successfully installed.

B. All materials shall be erected plumb, level and true, relative to the building structure. The maximum variation from plumb and level shall not exceed 1/8" (plus or minus) over ten feet.

C. Approved insulation materials shall be installed in the frame cavity on the interior portion of the window frame. Area adjacent to the exterior of the window frame shall remain uninsulated. The window installer shall use caution in the insulation operation to avoid overlapping insulation materials across the thermal-barrier connector thus bridging the two separate frame members.

3.2 CAULKING

A. A grade "A" type urethane caulking compound: Pecora, Tremco, Vulkem, or equal as approved by the Architect, shall be applied per the installation drawings and details at all points where the aluminum master frame and/or panning intersects the masonry or other exterior wall finish. The caulking material shall be applied in a manner which insures a continuous air- and water-tight perimeter seal. Color to match the color of the aluminum windows unless specified otherwise by the Architect.

3.3 TESTING

A. Laboratory Testing

1. At the discretion of the Owner, one or a number of operable sash shall be removed from windows installed on the project and exchanged with the appropriate attic stock. The selected stock shall be tested by a certified testing laboratory to verify that glass, glazing, hardware and finish are in conformance to the project specification. Should any component of the test specimen fail to conform to project specification, action shall be taken by the window manufacture to correct each deficiency for every window on the project at no additional cost to the Owner.
2. The Owner shall assume the cost of the initial verification testing. However, should product be found to be non-compliant, the manufacture shall reimburse the Owner for the cost of the initial test. At the architect's discretion, subsequent testing may be required and the cost of this test shall be borne by the manufacturer.

B. Field Testing

1. On-site testing shall be conducted at Owner's discretion and expense. Up to three test specimens shall be selected by Owner or architect.
2. On-site testing shall be conducted for sound transmission specified. NAVLAP-certified acoustic testing laboratory in accordance with ASTM E966 and including flanking test. Using ASTM E413 and ASTM E1332, respectively, specimens tested in the field shall be within five (5) points of the laboratory STC test results and three (3) points of the laboratory OITC test results furnished with product qualification.

3. If a test specimen shall fail any aspect of the field test, it shall be repaired or replaced and re-tested. At the architect's direction, up to three (3) additional windows may be tested. Upon completion of re-testing, all window units shall be repaired or replaced in the same manner as the test specimen(s) to assure compliance with project performance specification.
4. The cost of re-testing and all subsequent repairs and other associated expenses shall be borne by the window manufacture and/or window contractor.

3.4 ADJUSTMENTS, PROTECTION, AND CLEANING

A. After installation, the erector shall remove all sealants, caulking and other misplaced materials from all surfaces, including adjacent work. The window frame, sash and glass shall be cleaned thoroughly with materials and methods recommended by the window and glass manufacturers and shall not cause any defacement of the work.

B. Installer shall make any and all adjustments to window sash and hardware to cause the operating sash to function properly and in accordance with the Manufacturers standards

C. Protection of glass and window materials: Protect from contact with contaminating substances resulting from construction operations. After installation and cleaning of windows by window contractor, the general contractor shall be responsible for maintaining the cleanliness and protection of the window from damage from other trades.

D. Remove all sealant, caulking and other misplaced materials from all surfaces, including adjacent work. The window frames, casing, and glass shall be thoroughly cleaned with materials and methods recommended by the window and glass manufacturer and shall not cause any defacement of the work.

E. The general contractor shall be responsible for the protection of the work from damage by other trades.

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SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 Specification Sections and References, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:

    a. Mechanical door hardware for the following:

        1. Swinging doors.

    b. Cylinders for door hardware specified in other Sections.
    c. Electrified door hardware.

2. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: For power, signal, and control wiring and including the following:

    a. Details of interface of electrified door hardware and building safety and security systems.
    b. Schematic diagram of systems that interface with electrified door hardware.
    c. Point-to-point wiring.
    d. Risers.
    e. Elevations doors controlled by electrified door hardware.

2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.

1. Samples shall not be required when a contractor's proposed product is as specified by one of the listed manufacturers. Samples shall be required, however, when a particular product is unique in its specificity, function or operation.

2. Sample Size: Full-size units or minimum 2-by-4-inch Samples for sheet and 4-inch long Samples for other products.

a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

D. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
c. Content: Include the following information:

1) Identification number, location, hand, fire rating, size, and material of each door and frame.
2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
5) Fastenings and other pertinent information.
6) Explanation of abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for door hardware.
8) List of related door devices specified in other Sections for each door and frame.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Certificates:

1. Hardware Certifications:

a. Statement by Supplier that products meet specifications.
b. Statement by Manufacturer that product complies with applicable BHMA standard and tests.
c. Statement by Manufacturer certifying that the submitted hardware is approved for use on types and sizes of specified labeled fire doors and that it complies with listed fire door assemblies.

2. For electrified door hardware, from the manufacturer.

a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Keying Schedule:

1. Shall be prepared by the lock supplier in direct concert with Owner's keying instructions.
2. Shall be reviewed by the Architect for completeness and conformity to the specifications.
3. Shall be approved by Owner for compatibility with the district-wide keying philosophy.
4. Shall coordinate keying with Owner's Tech-Locksmith.

E. Maintenance Data: Key bitting.

1. Send electronic bitting to Owner's locksmith. Bitting schedule shall specifically identify the respective school and include all lock sets. Do not include the bitting schedule in the maintenance manuals.
2. Classroom Master: Provide minimum of 32 additional key bitting combinations to allow for classroom expansion.
3. Submit Division 01 section "Closeout Procedures" Exhibit D, signed by the Area Maintenance Supervisor, as a receipt for delivery of bitting schedule to include in maintenance manuals.

a. List all locksets included in bitting schedule by respective hardware set number on Exhibit D.

F. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hardware: 3 cylinder locks.
2. Electrical Parts: 1 electrified panic device and 1 rim panic device.
3. Closers: 3 universal arm closers.

1.7 QUALITY ASSURANCE

A. Installer/Contractor Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying. Must have experience in the successful installation of the specified materials and assemblies on similar projects for a minimum of five years.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:

1. For door hardware, an Architectural Hardware Consultant (AHC).

C. Manufacturer'(s) Qualifications: Employ only manufacturers making the specified products as a regular and current production item. Employ only manufacturers who are current members of the Builders Hardware Manufacturers Association (BHMA).

D. Source Limitations: Obtain each type of door hardware from a single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

E. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

G. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

H. Accessibility Requirements: For door hardware on doors in an accessible route, comply with Florida Building Code.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

I. Keying Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." In addition to Owner, Construction Manager, contractor and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Requirements for access control.
5. Address for delivery of keys.

J. Preinstallation and Post Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys and permanent cores to Owner through the Construction Manager.

1.9 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Five (5) years from date of Substantial Completion, unless otherwise indicated.

a. Manual Closers: Twenty (20) years from date of Substantial Completion.

1.11 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

C. Year-End Warranty Adjustment: Immediately prior to the year-end warranty period, all items of hardware and each door shall be re-examined and readjusted to ensure proper operation and function of every unit. Replace items that have deteriorated or failed due to faulty design, materials or installation.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

2.2 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies
b. IVES Hardware; an Allegion, PLC company
c. Stanley

2.3 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Backset: 2-3/4 inches, unless otherwise indicated.

C. Lock Trim:

1. Description: Schlage ND Series.
2. Levers:

a. Style: RHO.

D. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

E. Cylindrical Locks: BHMA A156.2; Operational Grade 1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Schlage Lock Company; an Allegion, PLC company; ND Series.- NO SUBSTIUTION

2.4 SURFACE BOLTS

A. Surface Bolts: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. IVES; an Allegion, PLC company.
b. Hager Companies.
c. Rockwood.

2.5 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. IVES; an Allegion, PLC company
b. Hager Companies.
c. Rockwood.

2.6 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3, including electrified panic devices.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Von Duprin; an Allegion, PLC company – NO SUBSTIUTION

B. Aluminum Door Deadbolt- Narrow Style
1. Manufacturers:: Subject to compliance with requirements, provide products by one of the following:
a. Adams Rite MS1850 series

2.7 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Schlage Lock Company; an Allegion, PLC company – NO SUBSTIUTION

B. Construction Cores: Where required provide construction cores that are replaceable by permanent cores to be returned to hardware supplier. Provide 10 construction master keys.

2.8 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.

2. All locks and cylinders shall be Schlage Everest T145 or T135 restricted key system, all bittings shall be issued by Schlage Lock.

3. All locks and cylinders to be construction master keyed in a manner that does not require the cylinders to be removed.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE.".

2. Quantity: In addition to one extra key blank for each lock, provide the following:

a. Cylinder Change Keys: Three.
b. Master Keys: Six per master system.
c. Grand Master Keys: Six per campus.
d. Extra Blank Keys: One per lock.

2.9 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Key Control.
b. Lund Equipment Co., Inc.
c. Telkee.

2. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2.10 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Glynn Johnson.
b. Rockwood.
c. IVES Hardware; an Allegion, PLC company.

2.11 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.

B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

C. Astragals: BHMA A156.22.

2.12 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force. Closers on wood and metal doors are to be THRU-BOLTED.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. LCN Closers; an Allegion, PLC company, 4040XP series

b. Corbin Russwin, DC2200 series

2.13 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.

B. Unless otherwise noted, provide floor stops when doors swing against drywall and wall stops when doors swing against masonry walls.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. IVES; an Allegion, PLC company.
b. Rockwood.

2.14 ELECTROMAGNETIC STOPS AND HOLDERS

A. Electromagnetic Door Holders: BHMA A156.15, Grade 1; wall-mounted electromagnetic single unit with strike plate attached to swinging door; coordinated with fire detectors and interface with fire alarm system for labeled fire-rated door assemblies.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. LCN; an Allegion company
b. Dor-O-Matic

2.15 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Rixson
b. Glynn-Johnson; an Allegion, PLC company.

2.16 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Zero International.
b. National Guard Products.
c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.

2.17 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Zero International.
b. National Guard Products.
c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.

2.18 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Quality
b. Rockwood.
c. IVES Hardware; an Allegion, PLC company.

2.19 POWER SUPPLIES

A. Power Supply

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Schlage/Von Duprin PS900 series

B. Padlocks

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Padlock
American 6200-NR-with 6 pin cylinder. KA111111 (one bitted).

2.20 FABRICATION

A. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

B. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Fire-Rated Applications:

a. Wood or Machine Screws: For the following:

1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
2) Strike plates to frames.

b. Steel Through Bolts: ALL CLOSERS AND EXIT DEVICES SNB, Optional on HM doors

1) Closers to doors and frames.
2) Surface-mounted exit devices.

2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.21 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

C. Where on-site modification of doors and frames is required:
1. When modifications are exposed to view, use concealed fasteners, when possible.
2. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
   a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
   b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
   c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated on Drawings for latch centerline and to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying schedule.

E. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.

1. Configuration: Provide one power supply for each door opening with electrified door hardware.

2. Provide labeling to indicate specific location of each door served by Power Supply

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

H. Stops: Provide wall stops for doors unless floor or other type stops are indicated in door hardware schedule; including stop closers. Do not mount floor stops where they will impede traffic.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Engage qualified manufacturer trained representative to perform inspections and to prepare inspection reports.

1. Representative will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 01 79 00 "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

HARDWARE GROUP NO. 01
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB	689	VON
1	EA	PANIC HARDWARE	98-EO-SNB	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-98-NL-CON-SNB 24 VDC	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30 SRT	689	LCN
2	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
2	EA	DOOR STOP	WS406/407CCV	630	IVE
1	EA	WIRE HARNESS	CON-LAR		VON
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		

DOORS NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS ACTIVE LEAF. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOORS ARE CLOSED AND SECURE SIDE IS LOCKED.

HARDWARE GROUP NO. 01A
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB	689	VON
1	EA	PANIC HARDWARE	98-EO-SNB	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-98-NL-CON-SNB 24 VDC	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30 SRT	689	LCN
2	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	WIRE HARNESS	CON-LAR		VON
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		

DOORS NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS ACTIVE LEAF. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOORS ARE CLOSED AND SECURE SIDE IS LOCKED.

HARDWARE GROUP NO. 01B
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB	689	VON
1	EA	PANIC HARDWARE	98-EO-SNB	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-98-NL-CON-SNB 24 VDC	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	SURF. AUTO OPERATOR	9542 HL/D AS REQ (120/240 VAC)	ANCLR	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 SRT	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
2	EA	ACTUATOR, TOUCH	8310-856T	630	LCN
2	EA	DOOR STOP	WS406/407CCV	630	IVE
1	EA	WIRE HARNESS	CON-LAR		VON
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		

DOORS NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS ACTIVE LEAF AND ALLOWS ACTIVE LEAF TO BE AUTO OPENED VIA ACTUATOR. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOORS ARE CLOSED AND SECURE SIDE IS LOCKED.

HARDWARE GROUP NO. 02
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB	689	VON
1	EA	PANIC HARDWARE	98-EO-SNB	626	VON
1	EA	PANIC HARDWARE	98-NL-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30 SRT	689	LCN
2	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
2	EA	DOOR STOP	WS406/407CCV	630	IVE
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		

HARDWARE GROUP NO. 02A
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB	689	VON
1	EA	PANIC HARDWARE	98-EO-SNB	626	VON
1	EA	PANIC HARDWARE	98-NL-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30 SRT	689	LCN
2	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
2	EA	FLOOR STOP	FS18S	BLK	IVE
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		

HARDWARE GROUP NO. 03
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	PANIC HARDWARE	9847-EO-SNB	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-9847-NL-SNB 24 VDC	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30 SRT	689	LCN
2	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
2	EA	DOOR STOP	WS406/407CCV	630	IVE
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		

DOORS NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS ACTIVE LEAF. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOORS ARE CLOSED AND LOCKED.

HARDWARE GROUP NO. 03A
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	PANIC HARDWARE	9847-EO-SNB	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-9847-NL-SNB 24 VDC	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30 SRT	689	LCN
2	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		

DOORS NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS ACTIVE LEAF. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOORS ARE CLOSED AND LOCKED.

HARDWARE GROUP NO. 04
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	9847-EO-SNB	626	VON
1	EA	PANIC HARDWARE	9847-NL-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30 SRT	689	LCN
2	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
2	EA	DOOR STOP	WS406/407CCV	630	IVE
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		

HARDWARE GROUP NO. 04A
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	9847-EO-SNB	626	VON
1	EA	PANIC HARDWARE	9847-NL-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30 SRT	689	LCN
2	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
2	EA	FLOOR STOP	FS18S	BLK	IVE
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		

HARDWARE GROUP NO. 05
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	98-NL-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 SRT	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		

HARDWARE GROUP NO. 06
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	QEL-98-NL-CON-SNB 24 VDC	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 SRT	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		

DOOR NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS DOOR. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOOR IS CLOSED AND SECURE SIDE IS LOCKED.

HARDWARE GROUP NO. 07
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	DEADBOLT	MS1850s	628	ADA
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	MAGNETIC LOCK	M490P 12/24 VDC	628	SCE
1	EA	PUSH/PULL BAR	9190EZHD-10"-NS	630-316	IVE
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 SRT	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
1	EA	PUSH BUTTON	631ALEX 12/24 VDC	603	SCE
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1	EA	MOTION SENSOR	SCANII 12/24 VDC	BLK	SCE
1	EA	POWER SUPPLY	BY SECURITY PROVIDER		VON
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		

DOOR NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL RELEASES MAGNETIC LOCK. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOOR IS CLOSED AND SECURE SIDE IS UNLOCKED. KEY REQUIRED TO LOCK.

HARDWARE GROUP NO. 08
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	DEADBOLT	MS1850s	628	ADA
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	PUSH/PULL BAR	9190EZHD-10"-NS	630-316	IVE
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 SRT	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1			BALANCE OF HARDWARE BY DOOR SUPPLIER		

HARDWARE GROUP NO. 09
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	FIRE RATED REMOVABLE MULLION	HH-9954B	689	VON
1	EA	PANIC HARDWARE	HH-98-EO-299F-SNB	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-HH-98-NL-299F-CON-SNB 24 VDC	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
2	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON

DOORS NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS ACTIVE LEAF. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOORS ARE CLOSED AND SECURE SIDE IS LOCKED.

HARDWARE GROUP NO. 10
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	FIRE RATED REMOVABLE MULLION	HH-9954B	689	VON
1	EA	PANIC HARDWARE	HH-98-EO-299F-SNB	626	VON
1	EA	PANIC HARDWARE	HH-98-NL-299F-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
2	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

HARDWARE GROUP NO. 11
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	HH-9847-NL-304L-SNB	626	VON
1	EA	PANIC HARDWARE	HH-9847-EO-304L-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
2	EA	GASKETING	188SBK PSA	BK	ZER
2	SET	MEETING STILE	328AA-S	AA	ZER
1	EA	THRESHOLD	566A-223	A	ZER
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

HARDWARE GROUP NO. 12
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	QEL-WS-9827-L-06-SNB 24	626	VON
1	EA	PANIC HARDWARE	WS-9827-EO-SNB	626	VON
2	EA	ROD AND LATCH GUARD	WS-LGO-3-	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
2	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON

DOORS NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS ACTIVE LEAF. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOORS ARE CLOSED AND LOCKED.

HARDWARE GROUP NO. 12A
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	QEL-WS-9827-L-06-SNB 24	626	VON
1	EA	PANIC HARDWARE	WS-9827-EO-SNB	626	VON
2	EA	ROD AND LATCH GUARD	WS-LGO-3-	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
2	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
2	EA	VIEWER	U698	626	IVE
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON

DOORS NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS ACTIVE LEAF. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOORS ARE CLOSED AND LOCKED.
MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 13
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	WS-9827-EO-SNB	626	VON
1	EA	PANIC HARDWARE	WS-9827-L-06-SNB	626	VON
2	EA	ROD AND LATCH GUARD	WS-LGO-3-	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
2	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

HARDWARE GROUP NO. 13A
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	WS-9827-EO-SNB	626	VON
1	EA	PANIC HARDWARE	WS-9827-L-06-SNB	626	VON
2	EA	ROD AND LATCH GUARD	WS-LGO-3-	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
2	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

HARDWARE GROUP NO. 14
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	SURFACE BOLT	SB360 12" T	604	IVE
1	EA	MULT PT STOREROOM	LM9380P6 06A	630	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
1	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

METAL Z-ASTRAGAL BY METAL DOOR SUPPLIER
MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 15
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	MULT PT STOREROOM	LM9380P6 06A	630	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 16
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

METAL Z-ASTRAGAL BY METAL DOOR SUPPLIER
MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 17
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

METAL Z-ASTRAGAL BY METAL DOOR SUPPLIER
MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 18
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	QEL-WS-9827-L-06-SNB 24	626	VON
1	EA	ROD AND LATCH GUARD	WS-LGO-3-	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
1	EA	VIEWER	U698	626	IVE
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON

DOOR NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS DOOR. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOOR IS CLOSED AND SECURE SIDE IS LOCKED.

HARDWARE GROUP NO. 19
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	WS-9827-L-06-SNB	626	VON
1	EA	ROD AND LATCH GUARD	WS-LGO-3-	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

HARDWARE GROUP NO. 19A
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	WS-9827-L-06-SNB	626	VON
1	EA	ROD AND LATCH GUARD	WS-LGO-3-	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
1	EA	VIEWER	U698	626	IVE
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

HARDWARE GROUP NO. 20
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	WS-9827-L-06-SNB	626	VON
1	EA	ROD AND LATCH GUARD	WS-LGO-3-	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 21
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	WS-9827-L-06-SNB	626	VON
1	EA	ROD AND LATCH GUARD	WS-LGO-3-	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

HARDWARE GROUP NO. 22
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	LOCK PROTECTOR	BLP-110	630	DON
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

HARDWARE GROUP NO. 23
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	3CB1HW 5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	LOCK PROTECTOR	BLP-110	630	DON
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER
1	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE

HARDWARE GROUP NO. 24
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	LOCK PROTECTOR	BLP-110	630	DON
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER

HARDWARE GROUP NO. 25
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	CLASSROOM LOCK	ND70P6D RHO	626	SCH
1	EA	LOCK PROTECTOR	BLP-110	630	DON
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	THRESHOLD	566A-223	A	ZER

HARDWARE GROUP NO. 26
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
2	EA	PANIC HARDWARE	LD-98-L-2-06-SNB	626	VON
4	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
5	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
2	EA	GASKETING	488SBK PSA	BK	ZER
2	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 26A
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
2	EA	PANIC HARDWARE	LD-98-L-2-06-SNB	626	VON
4	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
5	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
2	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 27
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
2	EA	PANIC HARDWARE	LD-98-L-2-06-SNB	626	VON
4	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
5	EA	FSIC CORE	23-030	626	SCH
2	EA	OH STOP	450S	630	GLY
2	EA	SURFACE CLOSER	4040XP RW/62A TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	GASKETING	488SBK PSA	BK	ZER
2	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 28
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB	689	VON
1	EA	FIRE EXIT HARDWARE	98-L-BE-F-06-SNB	626	VON
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
2	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 29
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB	689	VON
2	EA	FIRE EXIT HARDWARE	98-L-F-2-06-SNB	626	VON
4	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
5	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
2	EA	GASKETING	488SBK PSA	BK	ZER

MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 30
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB	689	VON
2	EA	FIRE EXIT HARDWARE	98-L-F-2-06-SNB	626	VON
4	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
5	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
2	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 31
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB	689	VON
2	EA	FIRE EXIT HARDWARE	98-L-F-2-06-SNB	626	VON
4	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
5	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP RW/62A TBSRT	689	LCN
2	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
2	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 32
Provide each DE door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	PANIC HARDWARE	9827-EO-LBR-SNB	626	VON
2	EA	SURFACE CLOSER	4040XPT DE ST-3073 TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	MAGNET	SEM7830 12V/24V/120V	689	LCN
1	SET	ASTRAGAL	139A	A	ZER
2	EA	GASKETING	488SBK PSA	BK	ZER
2	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 33
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CONST LATCHING BOLT	FB61T	630	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4040XP RW/62A TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 34 - Not Used

HARDWARE GROUP NO. 35
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CONST LATCHING BOLT	FB61T	630	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4040XP RW/62A TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
2	EA	DOOR BOTTOM	369AA	AA	ZER

MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 36
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CONST LATCHING BOLT	FB61T	630	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
2	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

METAL Z-ASTRAGAL BY METAL DOOR SUPPLIER

HARDWARE GROUP NO. 37
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CONST LATCHING BOLT	FB61T	630	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
2	EA	OH STOP	450S	630	GLY
2	EA	SILENCER	SR64	GRY	IVE

METAL Z-ASTRAGAL BY METAL DOOR SUPPLIER

HARDWARE GROUP NO. 38
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CONST LATCHING BOLT	FB61P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4040XP RW/62A TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 39
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CONST LATCHING BOLT	FB61P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB F	689	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 40
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CONST LATCHING BOLT	FB61P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

METAL Z-ASTRAGAL BY METAL DOOR SUPPLIER
MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 41
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	PANIC HARDWARE	98-EO-SNB	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-98-L-NL-06-CON-SNB 24 VDC	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
2	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	WIRE HARNESS	CON-LAR		VON
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON

DOORS NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS ACTIVE LEAF. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOORS ARE CLOSED AND LOCKED.

HARDWARE GROUP NO. 42
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB	689	VON
1	EA	FIRE EXIT HARDWARE	98-EO-F-SNB	626	VON
1	EA	ELEC FIRE EXIT HARDWARE	QEL-98-L-NL-F-06-SNB 24 VDC	626	VON
4	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
5	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
2	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
2	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
2	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	WIRE HARNESS	CON-LAR		VON
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON

DOORS NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS ACTIVE LEAF. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOORS ARE CLOSED AND LOCKED.
MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 43
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	LD-98-L-2-06-SNB	626	VON
2	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 44
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	LD-98-L-2-06-SNB	626	VON
2	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 44A
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	99-L-BE-06-SNB	626	VON
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 45
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-F-2-06-SNB	626	VON
2	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 46
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-F-2-06-SNB	626	VON
2	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 47
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	QEL-98-L-NL-06-CON-SNB 24 VDC	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	WIRE HARNESS	CON-LAR		VON
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON

DOOR NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS DOOR. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOOR IS CLOSED AND SECURE SIDE IS LOCKED.

HARDWARE GROUP NO. 48
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	98-L-NL06-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 49
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 50
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 50A
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 51
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 51A
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 52
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 52A
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	OH STOP	450S	630	GLY
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 52B
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53P6D RHO	626	SCH
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 53
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 54
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP/HOLDER	WS45	626	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 55
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 56
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 57
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	OH STOP	450S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 58 - Not Used

HARDWARE GROUP NO. 59
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	OH STOP	450S	630	GLY
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 60
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FAC RESTRM W/IND CYL	ND85P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 61
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FAC RESTRM W/IND CYL	ND85P6D RHO	626	SCH
1	EA	OH STOP	450S	630	GLY
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 62
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 63
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 64
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 65 - Not Used

HARDWARE GROUP NO. 66
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 67
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	OH STOP	450S	630	GLY
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 68
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 68A
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 69
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 70
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8302 8" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 71
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	WS406/407CCV OR FS436 AS REQUIRED	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA	AA	ZER

HARDWARE GROUP NO. 72
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	3CB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	PANIC HARDWARE	98-EO-WH-SNB	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-98-NL-WH-SNB 24 VDC	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP SRI TBSRT	689	LCN
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	MULTITECH READER	READER BY SECURITY PROVIDER	BLK	SCE
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
1			BALANCE OF HARDWARE BY GATE MANUFACTURER		

DOORS NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL UNLOCKS ACTIVE LEAF. FREE EGRESS AT ALL TIMES. UPON LOSS OF POWER DOORS ARE CLOSED AND LOCKED.
MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 73
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	PANIC HARDWARE	98-EO-WH-SNB	626	VON
1	EA	PANIC HARDWARE	98-NL-WH-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4040XP SRI TBSRT	689	LCN
2	EA	FLOOR STOP	FS18S	BLK	IVE
2	EA	DOOR CONTACT	BY SECURITY PROVIDER	BLK	SCE
1			BALANCE OF HARDWARE BY GATE MANUFACTURER		

MOUNT CLOSER FOR 180 DEGREE OPENING WHEN POSSIBLE

HARDWARE GROUP NO. 74
Provide each PR door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1		HARDWARE BY DOOR MANUFACTURER		

HARDWARE GROUP NO. 75
Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1		HARDWARE BY DOOR MANUFACTURER		

HARDWARE GROUP NO. 76
Provide each RU door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1		HARDWARE BY DOOR MANUFACTURER		

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SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Glass.

1.3 DEFINITIONS

A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

1.4 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- square Samples for glass.

1. Each glass type indicated.

C. Warranties: For glass types indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

B. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

C. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA'S "Glazing Manual".

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 degrees F.

1.8 WARRANTY

A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years if available otherwise 5 years, from date of Final Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Oldcastle BuildingEnvelope.
2. Pilkington North America.
3. PPG Flat Glass; PPG Industries, Inc.
4. Viracon, Inc.
5. Guardian Industries Corp.; SunGuard.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide exterior glazing capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified.

B. All exterior glazing (other than EHPA) shall meet the following minimum requirements:

1. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone indicated.

    a. Large-Missile Test: For glazing located within 30 feet of grade.
    b. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.

2. Glazing in EHPA shall meet enhanced Performance Requirements as listed below.

C. Structural design of systems will be the responsibility of the manufacturer and is to be designed to comply with the Florida Building Code along with additional wind loading as follows:

1. Code Conformance: Design of system shall comply with the requirements of ASCE-7, latest edition adopted by D.O.E. except as modified by this section.

D. EHPA areas shall be designed for wind loads in accordance with ASCE-7, latest edition adopted by D.O.E., Category 4 (Essential Buildings). See architectural drawings for the building(s) required to comply with the EHPA requirement.

1. EHPA Building Envelope shall comply with SBCCI/SSTD-12 for large missile impact criteria. Refer to architectural drawings for building envelope path and location.

E. Codes Compliance: Comply with requirements of the Florida Building Code for wind and impact resistance.

F. Delegated Design: Engage a qualified professional engineer, to design aluminum windows.

G. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

H. Glass Design: Glass thickness indicated is minimums and is for detailing only. Confirm glass thickness by analyzing Project wind loads for exterior glass and in-service conditions for exterior and interior glass.

I. Thermal Movements: Provide glazing that allows for thermal movements resulting from the maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components.

J. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.

1. Design Wind Pressures: As indicated on Drawings.

K. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

L. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For laminated-glass lites, properties are based on products of construction indicated.

2. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
3. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
4. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 FLOAT GLASS:

A. ASTM C 1036, Type I, Quality-Q3, Class I (clear).

2.4 HEAT TREATED FLOAT GLASS:

A. Fabrication Process: By vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option, except provide horizontal process where indicated as tongless or free of tong marks.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated.

2.5 TEMPERED GLASS

A. Tempered Glass: Clear fully tempered float glass.

1. Thickness: 1/4-inch, minimum.
2. Labeling: Provide safety glazing labeling.

2.6 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with the following to comply with interlayer manufacturer's written instructions:

1. Polyvinyl butyral interlayer.

2.7 MONOLITHIC-GLASS TYPES

A. Tempered Glass: Clear fully tempered float glass.

1. Thickness: 1/4-inch, minimum.
2. Labeling: Provide safety glazing labeling.

2.8 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.9 SPANDREL GLASS

A. Silicone-Coated Spandrel Glass: ASTM C 1048, Type I, Condition C, Quality-Q3.

1. Basis of design Manufacturer; Basis of design for Spandrel Coating Opaci-Coat 300, ICD High Performance Coatings. FIRE RATED GLAZING

2.10 FIRE SAFE GLAZING

A. Subject to compliance with requirements provide product by one of the following:

1. Glaverbel S.A., distributed by InterEdge Technologies
2. Oldcastle Glass
3. SAFTI *FIRST*
4. SCHOTT North America, Inc.
5. Nippon Electric Glass Co., Ltd.,
6. Vetrotech Saint-Gobain North America Inc.

B. Thickness: As required for fire-ratings indicated.

C. Fire-Protection Rating: As required for the assembly in which glazing material is installed.

1. Glazing for Fire-Rated Door and Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA.

D. Impact Safety Rating: As required for the assembly in which glazing material is installed.

1. Glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

E. Temperature-Rise Rating: As required for the assembly in which glazing material is installed.

F. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.11 ONE-WAY GLAZING

A. Pyrolytic Coated visual quality in accordance with ASTM C1376.

1. Basis of Design Product and Manufacturer; Manufacturer; Pilkington North America, Mirropane.

2.12 ELASTOMERIC GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range for this characteristic.

B. Elastomeric Glazing Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant in the Glazing Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

1. Additional Movement Capability: Where additional movement capability is specified in the Glazing Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C 920 for uses indicated.

2.13 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.14 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. For fire-rated glass use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

C. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

D. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

E. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

F. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

G. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

H. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

I. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

J. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

3.6 GLAZING SCHEDULE

A. Type GL-3: 1-5/16" Insulated Glazing Unit, Low-E, Tinted – Impact.

1. Basis of Design Manufacturer; PPG Flat Glass; PPG Industries, Inc.

a. Exterior Lite: fully tempered, 1/4-inch thick. Solarban 60, Solargray # 2 surface.
b. 3/8-inch air space.
c. Clear, fully tempered, 1/4-inch thick, .090 interalyer typical, provide .180 Kuraray SentryGlas Level-E at EHPA locations, laminated to 1/4-inch thick clear fully tempered glazing.

1) U-Value: 0.29.
2) Solar Heat Gain Coefficient (SHGC): 0.25.

B. Type GL-4: 5/8" Monolithic, Glazing Unit, Low-E, Clear – Impact.

1. Basis of Design Manufacturer; PPG Flat Glass; PPG Industries, Inc.

a. Clear, fully tempered, 1/4-inch thick, .090 interalyer typical, provide .180 Kuraray SentryGlas Level-E at EHPA locations, laminated to 1/4-inch thick clear fully tempered glazing.

C. Type GL-5: 5/8" Monolithic, Glazing Unit, Low-E, One Way Vision Glass – Impact.

1. Basis of Design Manufacturer; PPG Flat Glass; PPG Industries, Inc.

a. Clear, fully tempered, 1/4-inch thick, .090 interalyer typical, provide .180 Kuraray SentryGlas Level-E at EHPA locations, laminated to 1/4-inch thick one-way glazing

D. GT: Interior:

1. Glass for Interior Non-Fire Rated Doors and Windows: 1/4-inch clear tempered glass.

E. Interior Fire rated Glazing: Clear fire rated interior glazing.

1. Basis of Design Manufacturer; SAFTIFIRST.

a. Type FG-20 - 20 minute rated - SuperLite I.
b. Type FG-45 – 45 minute rated - SuperLite II-XL45.
c. Type FG-45 – 60 minute rated - SuperLite II-XL60.
d. Type FG-90 – 90- minute rated - SuperLite II-XL90.

END OF SECTION 08 80 00

SECTION 08 83 00
MIRRORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following types of silvered flat glass mirrors:

1. Safety mirrors.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Silvered mirrored glass. Include description of materials and process used to produce mirrored glass that indicates source of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include elevations, sections, details, and attachments to other Work.

C. Samples: For each type of the following products:

1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.

D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Source Limitations for Mirrored Glass: Obtain mirrored glass from one source for each type of mirrored glass indicated.

B. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each type of accessory indicated.

C. NAAMM's Publication: For silvered mirrored glass, comply with recommendations in NAAMM's "Mirrors, Handle with Extreme Care, Tips for the Professional on the Care and Handling of Mirrors."

D. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to mirrored glass manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For silvered mirrored glass, comply with mirrored glass manufacturer's written instructions for shipping, storing, and handling mirrored glass as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrored glass until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Special Warranty for Silvered Mirrored Glass: Written warranty, made out to Owner and signed by mirrored glass manufacturer agreeing to replace silvered mirrored glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below:

1. Warranty Period: Five years from date of manufacture.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRRORS

A. Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

B. Safety Glazing Products: For tempered mirrors, provide products that comply with 16 CFR 1201, Category II.

C. 1/4" Clear float glass, q3 glazing quality with chemically deposited silver and copper coating and a protective coating. Include a safety mat backing. Seal all edges with manufacturer’s recommended edge sealer, after cutting to size and polishing the edges.

2.2 MISCELLANEOUS MATERIALS

A. Setting Blocks: Neoprene, 70 to 90 Shore A hardness.

B. Edge Sealer: Coating compatible with glass coating and approved by mirrored glass manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Franklin International; Titebond Division.
b. Laurence, C. R. Co., Inc.
c. Palmer Products Corporation.

D. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

E. Anchors and Inserts: Provide devices as required for installation.

2.3 MIRROR HARDWARE

A. Perimeter Trim: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom, sides and top of each mirror.

1. Manufacturers: Subject to compliance with requirements, manufacturer's providing products that may be incorporated into the Work include, but are not limited to, the following:

a. Laurence, C. R. Co., Inc.
b. Sommer & Maca Industries, Inc.

2. Finish: Clear bright anodized.

2.4 FABRICATION

A. Mirrored Glass Sizes: Cut mirrored glass to final sizes and shapes to suit Project conditions.

B. Mirrored Glass Edge Treatment: Beveled edge.

C. Vinyl-Backed Safety Mirrored Glass: Apply vinyl backing with pressure-sensitive adhesive coating over glass coating as recommended by vinyl-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections. Use adhesives and vinyl backing compatible with mirrored glass as certified by organic coating manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrored glass units are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance.

1. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
2. Proceed with mirrored glass installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating surfaces with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrored glass units to comply with written instructions of mirrored glass manufacturer and with referenced GANA and NAAMM publications. Mount mirrored glass accurately in place in a manner that avoids distorting reflected images.

B. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

END OF SECTION 08 83 00

SECTION 08 91 19
FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fixed extruded-aluminum louvers.

1.3 ACTION SUBMITTALS

A. Product Approval: Submit current Product Approval documentation in accordance with the Florida Building Code.

B. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

C. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

D. Samples: For each type of metal finish required.

E. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

B. Windborne-debris-impact-resistance test reports.

C. Sample Warranties: For manufacturer's special warranties.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.6 WARRANTY

A. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Provide exterior opening capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified.

B. All exterior openings (other than EHPA) shall meet the following minimum requirements:

1. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone indicated.

a. Large-Missile Test: For glazing located within 30 feet of grade.
b. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.

2. Openings in EHPA shall meet enhanced Performance Requirements as listed below.

C. Structural design of systems will be the responsibility of the manufacturer and is to be designed to comply with the Florida Building Code along with additional wind loading as follows:

1. Code Conformance: Design of system shall comply with the requirements of ASCE-7, latest edition adopted by D.O.E. except as modified by this section.

D. EHPA areas shall be designed for wind loads in accordance with ASCE-7, latest edition adopted by D.O.E., Category 4 (Essential Buildings). See architectural drawings for the building(s) required to comply with the EHPA requirement.

1. EHPA Building Envelope shall comply with SBCCI/SSTD-12 for large missile impact criteria. Refer to architectural drawings for building envelope path and location.

E. Codes Compliance: Comply with requirements of the Florida Building Code for wind and impact resistance.

F. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.

G. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

H. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

I. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

J. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.2 MANUFACTURERS

A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Drainable-Blade Louver:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Ruskin Company; EME520MD or a comparable product by one of the following:

   a. Airolite Company, LLC (The).
   b. American Warming and Ventilating; a Mestek Architectural Group company.
   c. Construction Specialties, Inc.
   d. Greenheck.

2. Louver Depth: 5-inches.
3. Louver Size: As indicated.
4. Blade Profile: Plain blade without center baffle.
5. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
6. Finish: Fluoropolymer.
7. Louver Performance Ratings:

a. Free Area: Not less than 7.5 sq. ft. for 48-inch-wide by 48-inch-high louver.
b. Point of Beginning Water Penetration: Not less than 950 fpm.
c. Air Performance: Not more than 0.10-inch wg static pressure drop at 700-fpm free-area exhaust velocity.

8. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening.

B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Non-rewirable, U-shaped frames.

D. Louver Screening for Aluminum Louvers:

1. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.6 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Exterior flange unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.

G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.7 ALUMINUM FINISHES

A. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 91 19

Division 09
Finishes

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SECTION 09 21 16
GYPSUM BOARD SHAFT-WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Shaft enclosures.

1.3 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board construction not defined in this Section or in other referenced standards.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance:

1. Provide gypsum board shaft-wall assemblies capable of withstanding the full air-pressure loads indicated for maximum heights of partitions without failing and while maintaining an airtight and smoke-tight seal. Evidence of failure includes deflections exceeding limits indicated, bending stresses causing studs to break or to distort, and end-reaction shear causing track (runners) to bend or to shear and studs to become crippled.

1.5 SUBMITTALS

A. Product Data: For each gypsum board shaft-wall assembly indicated.

B. Fire-Test-Response Reports: From a qualified independent testing and inspecting agency substantiating each gypsum board shaft-wall assembly's required fire-resistance rating.

C. Research/Evaluation Reports: Evidence of compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction that substantiate required fire-resistance rating for each gypsum board shaft-wall assembly.

D. Acoustical-Test-Response Reports: From a qualified independent testing agency substantiating required STC rating for each gypsum board shaft-wall assembly.

1.6 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory" or GA-600, "Fire Resistance Design Manual" as indicated.

B. STC-Rated Assemblies: For gypsum board shaft-wall assemblies indicated to have STC ratings, provide assembly materials and construction complying with requirements of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Management and Coordination." Review methods and procedures for installing work related to gypsum board shaft-wall assemblies including, but not limited to, the following:

1. Fasteners proposed for anchoring steel framing to building structure.
2. Sprayed fire-resistive materials applied to structural framing.
3. Wiring devices in shaft-wall assemblies.
4. Doors and other items penetrating shaft-wall assemblies.
5. Items supported by shaft-wall-assembly framing.
6. Mechanical work enclosed within shaft-wall assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat on leveled supports off the ground to prevent sagging.

1.8 PROJECT CONDITIONS

A. Comply with requirements for environmental conditions, room temperatures, and ventilation specified in Division 9 Section "Gypsum Board Assemblies."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. G-P Gypsum Corp.
2. National Gypsum Company.
3. United States Gypsum Co.

2.2 ASSEMBLY MATERIALS

A. General: Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.

1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
2. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.

B. Steel Framing: ASTM C 645.

1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized coating.

C. Gypsum Liner Panels: Manufacturer's proprietary liner panels in 1-inch thickness and with moisture-resistant paper faces.

D. Gypsum Wallboard: ASTM C 36, core type as required by fire-resistance-rated assembly indicated.

1. Edges: Tapered.

E. Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 9 Section " Gypsum Board Assemblies" that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.

F. Gypsum Wallboard Joint-Treatment Materials: ASTM C 475 and as specified in Division 9 Section "Gypsum Board Assemblies."

G. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

H. Track (Runner) Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Powder-Actuated Fasteners: Provide powder-actuated fasteners with capability to sustain, without failure, a load equal to 10 times that imposed by shaft-wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 1190.
2. Postinstalled Expansion Anchors: Where indicated, provide expansion anchors with capability to sustain, without failure, a load equal to 5 times that imposed by shaft-wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 488.

I. Acoustical Sealant: As recommended by gypsum board shaft-wall assembly manufacturer for application indicated.

J. Sound Attenuation Blankets: ASTM C 665 for Type I, unfaced mineral-fiber-blanket insulation produced by combining thermosetting resins with mineral fibers manufactured from slag or rock wool.

2.3 GYPSUM BOARD SHAFT WALL

A. Deflection Limit: L/240.

B. Studs: Manufacturer's standard profile for repetitive members and corner and end members and for fire-resistance-rated assembly indicated.

1. Depth: As indicated.

C. Track (Runner): Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches, in depth matching studs.

1. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.

D. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches, in depth matching studs.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board shaft-wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Sprayed Fire-Resistive Materials: Coordinate with gypsum shaft-wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft-wall assemblies to comply with requirements specified in Division 7 Section "Sprayed Fire-Resistive Materials."

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches on center.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:

1. ASTM C 754 for installing steel framing.
2. Division 9 Section " Gypsum Board Assemblies" for applying and finishing panels.

B. Testing: Test walls indicated to have STC ratings in accordance with referenced standards.

C. Do not bridge building expansion joints with shaft-wall assemblies; frame both sides of joints with furring and other support.

D. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.

1. At elevator hoistway door frames, provide jamb struts on each side of door frame.
2. Where handrails directly attach to gypsum board shaft-wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 face-layer panel.

E. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

F. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.

G. Install control joints to maintain fire-resistance rating of assemblies.

H. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with manufacturer's written instructions or ASTM C 919, whichever is more stringent.

END OF SECTION 09 21 16

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SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings and soffits.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Studs and Runners: Provide documentation that framing members' certification is according to SFIA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members". SFIA's program certifies that studs and runners comply with the IBC, ASTM C 645, AISI S100, and AISI S220. Mechanical properties, coatings, dimensions, and labeling are checked.
2. Manufacturers' limiting tables indicating products provided.
3. Manufacturer's Certification: Submit manufacturer's certification of product compliance with codes and standards along with product literature and data sheets for specified products.
4. Evaluation Reports: For Metal Framing, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

B. Delegated-Design by Specialty Structural Engineer (SSE) Delegated-Design Submittal: For steel framing, ceiling framing, and related fasteners, accessories and support. The design professional, individual or organization having responsibility for the design of the specialty items. This responsibility shall be in accordance with the state's statues and regulations governing the professional registration and certification of architects or engineers.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation Reports: For firestop tracks post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft..

D. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design steel framing systems.

1. Design framing systems in accordance with American Iron and Steel Institute Publication S220 “North American Specification for the Design of Cold-Formed Steel Framing – Non-Structural Members”, except as otherwise shown or specified.
2. Design loads: 5 PSF minimum as required by the Building Code.
3. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of 1/240 inches and including finish material.

E. Fire-Test-Response Characteristics: Provide materials and construction identical to those tested according to ASTM E 119.

F. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

a. Interior Wall Framing: Horizontal deflection of L/240 of the wall height under a horizontal load of 5 lbf/sq. ft.

2.2 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. ClarkDietrich Building Systems
    b. MarinoWARE.
    c. MRI Steel Framing, LLC.
    d. SCAFCO Steel Stud Company.

2. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
3. Protective Coating: ASTM A 653/A 653M, G40 Typical, G60 at framing behind wet walls, hot-dip galvanized.
4. Depth: As indicated on Drawings.
5. Minimum Base-Metal Thickness: 0.0296 inch, except as indicated below.

    a. Framed openings (heads and jambs of door and window openings).

        1) (2) studs at each jamb, full height, and horizontal headers.

A. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

B. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Track System: ASTM C 645 top track with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inchesof the top of studs to provide lateral bracing.
2. Double-Track System: ASTM C 645 top outer tracks, inside track with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
3. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

C. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. SLP-TRK by Slip Track Systems
    b. Snap Track by Total Steel Solutions
    c. Slotted Stud by Steeler Inc.

D. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Depth: As indicated on Drawings.

E. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

F. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

G. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

H. Backerplates: Except grab bars for the handicapped, and railings use 6 in. wide 18 ga. galvanized sheet steel per ASTM A164, latest edition, type RS or heavier, lengths of backerplates as required, minimum length of 4 studs, fastened to studs for the attachment of surface mounted accessories, shelving locations, etc., at required locations and where indicated.

2.3 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.

B. Hanger Attachments to Concrete:

1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES as appropriate for the substrate.

a. Uses: Securing hangers to structure.
b. Type: Torque-controlled, expansion anchor torque-controlled, adhesive anchor or adhesive anchor.
c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.

1. Depth: 1-1/2 inches.
2. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

3. Protective Coating: ASTM A 653/A 653M, G90, hot-dip galvanized.

F. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0329-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
2. Steel Studs and Tracks: ASTM C 645.
3. Protective Coating: ASTM A 653/A 653M, G90, hot-dip galvanized.

a. Minimum Base-Metal Thickness: 0.0329 inch.
b. Protective Coating: ASTM A 653/A 653M, G90, hot-dip galvanized.
c. Depth: As indicated on Drawings.

G. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types and other assembly components indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Stud Spacing: 16-inches on center maximum.

E. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

    a. At locations indicated install sound isolation clips.
    b. Basis of Design Product and Manufacturer; Pac-International RSIC-1, or a comparable product by one of the following:

        1) Clark Dietrich.
        2) Marinoware.

6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

F. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
8. Attach hangers to concrete slab only. In no case should anchors be drilled or shot in to precast structural concrete beams or joists.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 24 00
CEMENT PLASTERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal lath and accessories.
2. Portland cement plaster.
3. Stucco finishes.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: When used with an entity, "experienced" means having successfully completed a minimum of 5 projects similar in size and scope to this Project; being familiar with special requirements indicated.

B. Mockups:

1. Size: 4-feet by 4-feet by full thickness with finish specified, using materials specified including all metal support systems and built on site.
2. Obtain Architect's approval of mockups prior to installation of Portland cement plaster work.
3. Fire-Test-Response Characteristics: ASTM E 119.

1.4 SUBMITTALS

A. Product Data: Submit product data for each product specified.

B. Material Certificates: Submit certificate signed by manufacturer for each kind of plaster aggregate certifying that materials comply with requirements.

C. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components and attachments to other work.

D. Samples for Verification: For each type of finish coat indicated; 12 by 12 inches and prepared on rigid backing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C1550-92, Type 1, natural color.

B. Masonry Cement: ASTM C90-93, Type S, natural white color.

C. Lime: ASTM C206-84 (1992), Type S, special finishing hydrating lime.

D. Aggregate: ASTM C987, natural sand.

E. Water: Clean, potable, without deposits harmful to stucco.

2.2 LATH

A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653, G60, hot-dip galvanized zinc coating.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Alabama Metal Industries Corporation; a Gibraltar Industries Company.
b. Clark Western Building Systems, inc.
c. Marino/Ware; Division of Ware Industries, Inc.
d. Cemco.

2. Diamond-Mesh Lath: Self-furring.

a. Weight: 3.4 lb/sq. yd.

B. Paper Backing: FS UU-B-790, Type I Grade D, Style 2, water-vapor permeable, uncreped, unreinforced, asphalt saturated; 60-minute water resistance.

1. Provide paper backing for lath at all locations.

2.3 ACCESSORIES

A. Plastic Accessories: Manufactured from high-impact PVC.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Alabama Metal Industries Company; a Gibraltar Industries company.
b. Plastic Components, Inc.
c. Vinyl Corp; a division of ClarkDietrich Building Systems.

2. Cornerbeads: With perforated flanges.

a. Smallnose cornerbead; use unless otherwise indicated.

b. Bullnose cornerbead, radius 3/4-inch minimum; use at locations indicated on Drawings.

3. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.

a. Square-edge style; use unless otherwise indicated.
b. Bullnose style, radius 3/4-inch minimum; use at locations indicated on Drawings.
c. Weep Screeds shall be perforated for lathed applications.

4. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.

2.4 MISCELLANEOUS MATERIALS

A. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.

B. Bonding Compound: ASTM C 932.

C. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.

2.5 PLASTER MIXES AND COMPOSITIONS

A. General: Comply with ASTM C 926 for base, scratch, and finish-coat mixes as applicable to plaster bases, materials, and other requirements indicated.

B. Base-Coat Mixes and Compositions: Proportion materials for respective base coats in parts by volume per sum of cementitious materials for each method of application and plaster base indicated. Adjust mix proportions to attain workability.

C. Scratch Coat Mix: Proportion by volume in accordance with ASTM C926, for substrates indicated.

D. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:

1. Portland Cement Mixes:

a. Scratch Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material (sum of separate volumes of each component material).
b. Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material (sum of separate volumes of each component material).

E. Base-Coat Mixes for Use over Unit Masonry and Concrete: Single base (scratch) coat for two-coat plasterwork on high-absorption plaster bases as follows:

1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.

F. Job-Mixed Finish Coats: Proportion materials for finish coats in accordance with ASTM C926; finish to match Architect's samples.

G. Mixing: Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION OF LATH AND FURRING, GENERAL

A. Standards: Comply with ML/SFA 920, "Guide Specifications for Metal Lathing and Furring," and with requirements of ASTM C 1063.

3.2 INSTALLATION OF PLASTERING ACCESSORIES

A. General: Comply with referenced lathing and furring installation standards for provision and location of plaster accessories of type indicated. Miter or cope accessories at corners; install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories in place and in alignment during plastering.

1. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Control Joints: Install at locations indicated or, if not indicated, at locations complying with the following criteria and approved by Architect:

1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:

   a. Vertical Surfaces: 144 square feet.
   b. Horizontal and other Non-vertical Surfaces: 100 square feet.

2. At distances between control joints of not greater than 18 feet on center.
3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
4. Where control joints occur in surface of construction directly behind plaster.
5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.3 PLASTER APPLICATION

A. General: Comply with ASTM C 926.

1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces when measured by a 10-foot straightedge placed on surface.

2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Bonding Compound: Apply on unit masonry and concrete substrates for direct application of plaster.

C. Walls; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork with 3/4-inch total thickness, as follows:

1. Portland cement mixes.

D. Walls; Base-Coat Mix: For base (scratch) coat, for two-coat plasterwork and having 3/8-inch thickness on masonry 1/4-inch thickness on concrete, as follows:

1. Portland cement mix.

E. Finish Coats: Apply finish coats to comply with PCA Portland Cement Plaster (Stucco) Manual, and the following requirements:

1. Texture: Fine Sand.

F. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other work. Repair cracks and indented surfaces. Point-up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

G. Remove temporary covering and other provisions made to minimize spattering of plaster on other work. Promptly remove plaster from door frames, windows, and other surfaces not to be plastered. Repair surfaces stained, marred or otherwise damaged during plastering work. When plastering work is completed, remove unused materials, containers, equipment, and plaster debris.

1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure plaster work is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09 24 00

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SECTION 09 26 13
VENEER PLASTER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide labor, materials, services, and equipment necessary to complete veneer plastering work as shown on the Drawings or schedules and specified herein.

1.3 SUBMITTALS

A. Manufacturer's Data: Submit 2 copies of manufacturer's specifications and installation instructions for each material, and include other data as may be required to show compliance with these specifications. Indicate by transmittal form that a copy of each installation instruction has been distributed to the installer.

B. Manufacturer’s Certification: Submit certification that products meet or exceed specified requirements.

C. Submit two samples, 12 inch x 12 inch of veneer plaster on gypsum backing board indicating typical finish requirements.

D. Mock-up.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver manufactured materials in the original packages, containers, or bundles and bearing the name of the manufacturer and the brand. Except as otherwise specified herein, the mixing, installation, and application of manufactured material shall be in strict accordance with the printed directions of the manufacturer.

B. Protect plaster and associated materials against dampness until used. Store materials off the ground, under cover, and away from sweating walls and other damp surfaces. Protect metal accessories in a manner to prevent rusting. Do not install rusted metal accessories in the Work.

1.5 PROJECT CONDITIONS

A. Maintain a minimum temperature of 55 deg F in spaces to be plastered for at least 7 days before plastering, during plastering, and until plaster has cured. Protect plaster from freezing and from uneven or too rapid drying. Do not apply plaster to surfaces that contain frost. After plaster has set hard, provide and maintain free circulation of air to prevent sweatouts.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with the following:

1. Apply gypsum backing board in accordance with ASTM C844 and GA 216.
2. Apply gypsum veneer plaster in accordance with ASTM C843.
3. Perform work in accordance with GA 201 and GA-600.

B. Maintain one copy of each document on site.

C. Mock-up:

1. Provide mockup of plaster system with accessories under provisions of Section 01400.
2. Construct mockup, 4 feet long by 24 inches wide, illustrating surface finish and assembly.
3. Locate where directed.
4. Mockup may not remain as part of the work.

1.7 REGULATORY REQUIREMENTS

A. Conform to and ASTM E119 for fire rated assemblies in conjunction with Sections as follows:

1. Fire Rated Partitions: Listed assembly by UL.
2. Fire Rated Ceiling and Soffits: Listed Assembly by UL.
3. Fire Rated Structural Column Framing: Listed assembly by UL.
4. Fire Rated Structural Beam Framing: Listed assembly by UL.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. One-Component Gypsum Veneer Plaster: ASTM C 587, formulated for application directly over substrate without use of separate base-coat material.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirement, provide one of the following:

a. G-P Gyprum; DensArmor Cote Interior Veneer Plaster.
b. National Gypsum Company; X-KALibur Plaster.
c. USG Corporation; Diamond Interior Finish Plaster.
d. Bond Coat: ASTM C631, vinyl polymer type.

2.2 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.

B. Bonding Agent: ASTM C 631, polyvinyl acetate.

C. Patching Mortar: Dry-pack patching mortar, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

2.3 MIX DESIGN

A. Mix plaster in accordance with ASTM C587 and the manufacturer's instructions.

2.4 ACCESSORIES

A. Reveal: Fry Reglet DRMV25. Painted finish with custom color as selected by the Architect.

PART 3 - EXECUTION

3.1 VENEER PLASTERING

A. Gypsum Veneer Plaster Application Standard: Comply with ASTM C843.

B. Mixing and Application: Machine mix plaster, except for small amounts of work requiring less than one bag of plaster; and apply to substrate either by machine or by hand as required to produce the required texture of finished plastering.

C. Install metal corner beads at external corners of veneer plaster work.

D. Corner Opening Reinforcing: Install glass fiber mesh at 45 degrees at openings in the plane of the plaster surface such as doors and windows. Mesh strips shall be 4 inches wide and a minimum of 9 inches long installed following manufacturer's recommendations.

E. Apply "base coat" and distribute as evenly as possible, smoothing out the variance in the surface of the substrate. The average thickness of the base coat is 1/8 inches thick from the high points of the substrate. Light scratch finish to provide key for finish coat. Allow to dry two hours before applying finish coat. Apply finish coat 1/8 inch average thickness. Trowel finish coat to a smooth, dense finish.

3.2 MOISTURE RETENTION, CURING

A. Dampen previous plaster coats which have dried out before time for applications of next coat. Dampen with water as required for uniform suction. The Contractor is responsible for determining the most effective procedure for cutting and time lapse between application of coats based on climatic and job conditions. Plaster which is cracked or crazed due to improper timing and curing will not be accepted. Remove and replace defective plaster, including plaster base materials, if damaged during removal of defective plaster.

3.3 CLEANING AND PATCHING

A. Provide temporary covering and whatever other provisions are needed to minimize spattering of plaster on other work. Promptly remove plaster from door frames, windows, and other surfaces that are not to be plastered. Repair surfaces which have been stained, marred, or otherwise damaged during the plastering work. When plastering work is completed, remove unused materials, containers, equipment, and plaster debris.

B. Upon completion point up plaster around trim and other work. Cut out and patch defective and damaged plaster, including damaged existing plaster. Patching of plaster shall match adjacent plaster in texture and finish.

END OF SECTION 09 26 13

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.5 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36 or ASTM C 1396, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. G-P Gypsum.
b. Lafarge North America Inc.
c. National Gypsum Company.
d. USG Corporation.

B. Regular Type and Type X (fire rated):

1. Thickness: As indicated.
2. Long Edges: Tapered.

C. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396. With moisture- and mold-resistant core and paper surfaces.

1. Thickness: As indicated on Drawings.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

D. Abuse-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Gypsum.
b. Georgia-Pacific Building Products.
c. National Gypsum Company.
d. United States Gypsum Company.

2. Thickness: As indicated.
3. Long Edges: Taper
4. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
5. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
6. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
7. Hard Body Impact" ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.

E. Impact-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.

1. Basis-of-Design Product: Subject to compliance with requirements, provide National Gypsum Company; Hi-Impact Brand XP Fire-Shield Wallboard or a comparable product by one of the following:

   a. American Gypsum.
   b. Georgia-Pacific Building Products.
   c. United States Gypsum Company.

2. Core: As indicated on Drawings.
3. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
4. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
5. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
6. Hard Body Impact" ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
7. Long Edges: Tapered.
8. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.2 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. American Gypsum.
   b. CertainTeed Corporation.
   c. Georgia-Pacific Building Products.
   d. National Gypsum Company.

2. Core: As indicated on Drawings.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges, for use in all areas exposed to moisture.

1. Basis-of-Design Product: Subject to compliance with requirements, provide National Gypsum Company; PermaBase or a comparable product by one of the following:

   a. CertainTeed Corporation.
   b. United States Gypsum Company.

2. Thickness: As indicated.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Paper-faced galvanized steel sheet.
2. Shapes: As indicated.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening backer board, use screws of type and size recommended by panel manufacturer.

C. Acoustic Sealant: Refer to Section 07 92 00 “Joint Sealants.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS

A. General: Comply with ASTM C 840.

B. Examine panels before installation. Reject panels that are wet or moisture damaged.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetration

E. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

F. Penetrations:

1. Refer to Section 07 84 13 Penetration Firestopping regarding sealing of wall and ceiling penetrations.
2. Seal around all non-fire rated penetrations of gypsum panel walls and ceilings completely to minimum of Smoketight requirements.

3.3 INSTALLING TRIM ACCESSORIES

A. General: Attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 in specific locations identified, where approved by Architect, as indicated on the Drawings, and as follows:

1. Ceilings: Unless otherwise indicated install control joints as follows:

a. Install control joints in areas exceeding 2500 sq. ft.
b. Space control joints not more than 50 feet on center.
c. Install control joints where ceiling framing or furring changes direction.

2. Partitions and Furring: Unless otherwise indicated install control joints as follows:

a. Install control joints in partitions and wall furring runs exceeding 30 feet.
b. Space control joints not more than 30 feet on center.
c. Install control joints in furred assemblies where control joints occur in base exterior wall.

3.4 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 3: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 4: All other locations.
3. Level 5: Locations indicated on the Drawings.

E. Tile Backer Board Units: Finish according to manufacturer's written instructions.

3.5 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet or moisture damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

END OF SECTION 09 29 00

SECTION 09 30 13
TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Tile.
2. Waterproofing and crack isolation membrane.
3. Waterproofing sheet material.
4. Metal edge strips.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish require
2. Metal edge and cove strips in 6-inch lengths.

1.4 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

1. Joint sealants.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 2 percent of amount installed, for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 2 percent of amount installed for each color and type indicated.

B. All extra materials shall be in original manufacturers' containers, sealed, marked with stock number, color number, tile name, etc. Deliver to Owner with a transmittal sheet indicating each item and quantity.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

2.2 TILE

A. Basis of Design Product and Manufacturer; as indicated on the Finish Schedule; Subject to compliance with requirements, other available manufacturers offering products that may be incorporated into the Work include the following:

1. American Olean; a division of Dal-Tile Corporation.
2. Crossville, Inc.
3. Interceramic.

B. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

1. Base: Coved with surface bullnose top edge, face size as Indicated.
2. Wainscot Cap: Surface bullnose, face size module size same as adjoining flat tile.
3. External Corners: Surface bullnose, module size same as adjoining flat tile.
4. Internal Corners: Cove, module size module size same as adjoining flat tile.

2.3 TILE ACCESSORIES

A. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, anodized aluminum, with flanges for setting in mortar bed.

1. Basis of Design Product and Manufacturer: Refer to Finish Schedule.

a. Subject to requirement, other manufacturers offering products which may be incorporated into the work are but not limited to the following:

1) Blanke Corporation.
2) Ceramic Tool Company, Inc.

2.4 SETTING MATERIALS

A. Basis-of-Design Product: Subject to compliance with requirements, provide MAPEI Corporation; or a comparable product by one of the following:

1. Bostik, Inc.
2. Custom Building Products.
3. LATICRETE SUPERCAP, LLC.

B. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

C. Modified Dry-Set Mortar (Thinset): ANSI A118.4 and 118.11..

1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

D. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

2.5 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

2.6 WATERPROOFING AND CRACK SUPPRESSION MEMBRANE

A. Thin Set Applications: Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include:

a. Custom Building Products; Redgard Waterproofing and Crack Prevention Membrane.
b. Laticrete International, Inc.; Hydro Ban.
c. MAPEI Corporation; Mapelastic HPG.

2.7 SHOWER PAN MEMBRANE

A. Thick Set Applications, install in accordance with TCNA, TCA #112 for 2-inch depressions, and TCA #121 for 3-inch depressions with leveling compound sloped to drain.

1. "Chloraloy 240" chlorinated polyethylene (CPE) shower pan membrane by The Noble Company, or “Kerdi-Drain” by Schluter Systems.
2. Membrane shall comply with ASTM D 4068.
3. Waterproof membrane shall be installed on sloped mortar to provide minimum slope to drains as required by the manufacturer’s written installation instructions.

2.8 SEALANTS

A. Products and Manufacturers: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:

1. Keracaulk S (sanded); MAPEI Corporation

a. Colors: To be selected by the Architect from manufacturer’s full line.

2.9 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.10 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile walls installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.

1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. For all thin-set tile applications prepare substrates to receive waterproofing and fracture membrane materials in accordance with manufacturer’s instructions and recommendations.

E. Field-Applied Temporary Protective Coating: Where recommended by the tile manufacturer or as needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION, GENERAL

A. Workmanship and Visual Appearance: All tile shall be installed with zero-lippage, with straight and even joints, and smooth and flat. The intent is that all tile installations are to be installed using the best of techniques. Any tile that does not meet or exceed the requirements indicated shall be removed and replaced in accordance with specified requirements.

B. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated.

C. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods for applications indicated.

D. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

E. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

F. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles so walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

H. Metal edge and cove strips: Install at locations indicated.

3.4 WATERPROOFING AND CRACK ISOLATION MEMBRANE INSTALLATION

A. Install waterproofing to comply with manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials until membrane has cured and been tested to determine that it is watertight.

3.5 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.

B. Joint Widths: Install tile on floors with the following joint widths:

1. Tile: 1/8 inch

C. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in modified dry-set mortar (thinset).
2. Do not extend waterproofing or crack isolation membrane under thresholds set in modified dry-set mortar. Fill joints between such thresholds and adjoining tile set on waterproofing or crack isolation membrane with elastomeric sealant.

D. Metal Edge Strips: Install at locations indicated.

3.6 WALL TILE INSTALLATION

A. General: Install types of tile designated for wall installations to comply with TCA installation methods and ANSI setting-bed standards for applications indicated.

B. Joint Widths: Install tile on walls with the following joint widths:

1. Tile: 1/8 inch

3.7 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09 30 13

SECTION 09 51 13
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Acoustical ceiling tile.
2. Exposed grid suspension systems.
3. Perimeter and trim Accessories.

1.3 SUBMITTALS

A. Product Data: For products indicated.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Ceiling Panels: Set of 12-inch- square Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.

C. Maintenance Data: For ceiling panels and grid.

1.4 QUALITY ASSURANCE

A. Source Limitations:

1. Ceiling Panels: Obtain through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

a. Smoke-Developed Index: 450 or less.

C. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: Armstrong World Industries, Lancaster, Pennsylvania

B. Products of the following manufacturers are acceptable, providing their products equal or exceed the quality specified, and they can provide products of the type, size, function, and arrangement required.

1. Celotex Corporation.
2. Rockfon.
3. USG Interiors Inc.

2.2 MATERIALS

A. Standard for Acoustical Ceiling Units: ASTM E 1264 classifications as designated by reference to types, patterns, acoustical ratings, and light reflectance's, unless otherwise indicated.

1. Colors and Patterns: Provide products to match appearance characteristics indicated under each product type.

B. Acoustic Ceiling Panels

1. Basis of Design Products and Manufacturer:

    a. Type A1 – Armstrong 1728 Fine Fissured, 24” X 24” and 24” X 48” X 7/8”, Square Edge Lay In, White, Prelude XL 15/16” Exposed Tee in White.
    b. Type A2 – Armstrong 1754 Fine Fissured (High NRC), 24” X 24” X 7/8”, Square Edge Lay In, White, Prelude XL 15/16” Exposed Tee in White.
    c. Type A3 – Armstrong 673 Kitchen Zone, 24” X 24” X 5/8”, Square Edge Lay In, White, Prelude XL 15/16” Exposed Tee in White.
    d. Type A4 – Armstrong 3102 Painted Nubby, 24” X 24” X 1”, Square Edge Lay In, White, Prelude XL 15/16” Exposed Tee in White.
    e. Type A5 – Armstrong 2904 Shasta, 24” X 24” X 5/8”, Perforated, Square Edge Lay In, White, Prelude XL 15/16” Exposed Tee in White.

C. Standard for Acoustical Ceiling Units: ASTM E 1264 classifications as designated by reference to types, patterns, acoustical ratings, and light reflectance’s, unless otherwise indicated.

1. Colors and Patterns: Provide products to match appearance characteristics indicated under each product type.

2.3 CEILING SUSPENSION SYSTEMS

A. Basis of Design: Prelude XL, Armstrong World Industries, Lancaster, Pennsylvania

1. Chicago Metallic Corporation.
2. Donn “DX” by USG Interiors Inc.
3. Rockfon.

B. Grid Colors:

1. Typical white grid for white ceiling tile.

C. Suspension systems shall meet or exceed the requirements of ASTM C 635 for dimensional tolerances, coatings and finishes, and load carrying capabilities. Individual component deflection shall not exceed 1/360 of the span.

D. Finishes and Colors: Provide hot-dipped galvanized finish (G-30 minimum) on all ceiling suspension components. Exposed surfaces of suspension system components shall receive white baked-on enamel paint.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

E. Acoustical Lay-In System: Grid with 15/16" face.

F. Provide hold down clips and edge clips at locations as indicated and the following:

1. A.C.T. located in vestibules

G. Wall channel: Hemmed edge type.

H. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

I. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

2.4 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

2.5 MISCELLANEOUS MATERIALS

A. Concealed Acoustical Sealant: Nondrying, nonhardening, nonskinning, nonstaining, non-bleeding gunnable sealant complying with requirement specified in Section 07 92 00, Sealants and Caulking.

2.6 ACOUSTICAL SEALANT

A. Products:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corp; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with ASTM C 636 per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not attach hangers to steel roof deck. Attach hangers to structural members.
6. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
2. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

SECTION 09 54 23
LINEAR METAL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes strip, linear metal pans and suspension systems for ceilings.

1.3 COORDINATION

A. Coordinate layout and installation of linear metal pans and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For components with factory-applied color and other decorative finishes.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below:

1. Linear Metal Pan: Set of 12-inch-long Samples of each type and color and a 12-inch-long spliced section.
2. Suspension System Members: 12-inch-long Sample of each type.
3. Exposed Molding and Trim: Set of 12-inch-long Samples of each type, finish, and color.
4. Filler Strips: Set of 12-inch-long Samples of each type, finish, and color.
5. Sound Absorber: 12 inches long.
6. End Cap: Full size.

D. Delegated-Design Submittal: For design of attachment devices.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Linear pattern.
2. Joint pattern.
3. Ceiling suspension members.
4. Method of attaching hangers to building structure.

a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

5. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
6. Ceiling perimeter and penetrations through ceiling; trim and moldings.
7. Minimum Drawing Scale: 1/8 inch = 1 foot.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each linear metal ceiling, for tests performed by a qualified testing agency.

D. Evaluation Reports: For linear metal ceiling and components and anchor and fastener type.

E. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Linear Metal Ceiling Components: Quantity of each pan, carrier, accessory, and exposed molding and trim equal to 2 percent of quantity installed.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by National Voluntary Laboratory Accreditation Program for testing indicated.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver linear metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Handle linear metal pans, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Do not install linear metal ceilings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.12 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:

1. Acoustical Panels: Sagging and warping
2. Grid System: Rusting and manufacturer's defects

B. Warranty Period:

1. Acoustical Metal panels: One (1) year from date of substantial completion
2. Grid: Ten (10) years from date of substantial completion

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design attachment devices.

B. Structural Performance: Exterior linear metal ceilings shall withstand exterior exposure and the effects of gravity loads and the following loads and stresses without showing permanent deformation of ceiling system components including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling pans; or permanent damage to fasteners and anchors:

1. Wind Load: Uniform pressure as indicated on Drawings, acting inward or outward.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

D. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 450 or less.

2.2 LINEAR METAL CEILING PANS

A. Acoustical Metal Pan Standard: Provide manufacturer's standard linear metal pans of configuration indicated that comply with ASTM E 1264 classifications as designated by types, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

B. Sheet Metal Characteristics: For metal components exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.

1. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled; with protective coating complying with ASTM C 635/C 635M.

a. Painted Finishes: Electrolytic zinc-coated steel complying with ASTM A 879/A 879M, 04Z coating; surface treatment as recommended by finish manufacturer for type of use and finish indicated.

C. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated to snap on and be securely retained on carriers without separate fasteners, and finished to comply with requirements indicated.

D. Pan Splices: Construction same as pans, in lengths 8 to 12 inches; with manufacturer's standard finish.

E. End Caps: Metal matching pans; fabricated to fit and conceal exposed ends of pans.

F. Filler Strips: Metal matching pans; fabricated to uninterruptedly close voids between pans.

G. Moldings and Trim: Provide manufacturer's standard moldings and trim for exposed members, and as indicated or required, for edges and penetrations of ceiling, around fixtures, at changes in ceiling height, and for other conditions; of same metal and finish as linear metal ceiling pans.

H. Sound-Absorbent Pads: Provide width and length to completely fill between carriers, joined at center of panel, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84, and to comply with the following requirements:

1. Unwrapped, Glass-Fiber Insulation: Black-coated, unfaced, glass-fiber insulation complying with ASTM C 553, Type I, II, or III, not less than 1-lb/cu. ft. density, treated to be nondusting, and as follows:

    a. Thickness: 1-1/2 inches.

2.3 METAL SUSPENSION SYSTEMS

A. Metal Suspension Systems Standard: Provide ceiling manufacturer's standard metal suspension systems of types and finishes indicated that comply with applicable ASTM C 635/C 635M requirements.

B. Suspension Systems: Provide systems complete with carriers, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, Direct Hung, unless otherwise indicated.

1. Cast-in-Place and Postinstalled Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

    a. Type: Cast-in-place, Postinstalled expansion, or Postinstalled bonded anchors.
    b. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wire complying with the following requirements:

1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.

E. Hanger Rods and Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed from 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

G. Carriers: Factory finished with matte-black baked finish.

1. Main Carriers: Aluminum, not less than 0.240-inch rolled sheet, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, complying with ASTM B 209.
2. Main Carriers: Steel, not less than 0.0209-inch nominal thickness, cold-rolled sheet, with factory-applied protective coating, complying with ASTM C 635/C 635M.

a. Electrolytic Zinc-Coated Steel: ASTM A 879/A 879M, not less than 08Z zinc coating.
b. Hot-Dip Galvanized Steel: ASTM A 653/A 653M, not less than G60 zinc coating.

3. Adaptable Carriers: Manufacturer's standard carriers for direct attachment to existing suspended tees.
4. Flexible Radial Carriers: Manufacturer's standard radial carriers.
5. Expansion Carriers: Manufacturer's standard carriers allowing for irregularities or other unusual space conditions.

H. Carrier Splices: Same metal, profile, and finish as for carriers.

I. Stabilizer Channels, Tees, and Bars: Manufacturer's standard components for stabilizing main carriers at regular intervals and at light fixtures, air-distribution equipment, access doors, and other equipment; spaced as standard with manufacturer for use indicated; and factory finished with matte-black baked finish.

J. Exterior Bracing: Cold-rolled steel channels and angles, hot-dip galvanized to comply with ASTM A 653/A 653M, G60 coating designation; size and profile as required to withstand wind load.

K. Hold-Down Clips: Manufacturer's standard hold-down clips spaced as standard with manufacturer.

L. Edge Moldings and Trim: Provide exposed members as indicated or required to comply with requirements of authorities having jurisdiction, to conceal edges of penetrations through ceiling, to conceal ends of pans and carriers, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching linear metal pans or extruded plastic unless otherwise indicated.

1. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.

2.4 LINEAR METAL CEILING - STEEL PANS

A. Steel Pans and Suspension System:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries; MetalWorks Linear Classics – Perforated Item # 5492 and Item # 8123, or a comparable product by one of the following:

a. Chicago Metallic Corporation.
b. Hunter Douglas Architectural Products, Inc.
c. USG Corporation.

B. Surface: Smooth.

C. Color: Effects - Walnut.

D. Size: 8 inch x 96 inches x 5/8 inch.

E. 4 inch and 10 inch Microperforated, with plain border and acoustical fleece, in pattern as indicated.

F. End Cap, Finish of Exposed Portions: Manufacturer's standard finish.

G. Filler Strip Design: Manufacturer's standard.

H. Reveal: As indicated on the drawings.

I. Pans for interior use shall complying with ASTM E 1264 for Type XX, pattern G, other types described as perforated steel strips with sound-absorbent fabric backing.

1. NRC: 8200T10 - 1" Fiberglass Infill Panel (in poly bag) to achieve NRC .70

J. Suspension-System Main-Carrier Material: Manufacturer's standard material and protective finish.

2.5 ACCESSORIES

A. Access Panels: For access at locations indicated, provide door hinge assembly, retainer clip, and retainer bar, assembled with ceiling panels and carrier sections into access doors of required size, permitting upward or downward opening.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

2.7 STEEL SHEET FINISHES

A. Color-Coated Finish: Manufacturer's standard powder-coat baked paint finish complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which linear metal ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of linear metal ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of linear metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and on Coordination Drawings.

3.3 INSTALLATION

A. Comply with ASTM C 636/C 636M, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate to which hangers are attached and for type of hanger involved.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that does not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers but without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of linear metal ceiling area and where necessary to conceal edges and ends of linear metal pans.

1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system carriers so they are aligned and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Cut linear metal pans for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.

G. Install linear metal pans in coordination with suspension system and exposed moldings and trim.

1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
2. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.
3. Install pans with butt joints using internal pan splices and in the following joint configuration:

    a. Aligned.
    b. Aligned, every other pan length.
    c. Staggered a minimum of 12 inches.
    d. Random.
    e. As indicated.

4. Install directionally textured metal pans in directions indicated.
5. Where metal pan ends are visible, install end caps unless trim is indicated.
6. Install filler strips where indicated.
7. Install sound-absorbent pads at right angle to perforated metal pans so pads do not hang unsupported.

H. Install hold-down clips where indicated.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Suspended ceiling system.
2. Hangers, anchors, and fasteners.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Tests and Inspections: Testing and inspecting of completed installations of linear metal ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of linear metal ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.

1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.

a. Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select 1 of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Linear metal ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 CLEANING

A. Clean exposed surfaces of linear metal ceilings, including trim and edge moldings after removing strippable, temporary protective covering if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION 09 54 23

SECTION 09 64 66
WOOD FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide labor, materials, and equipment necessary for complete wood flooring work, including finish, painted lines and symbols, and vented rubber base as detailed on the Drawings and as specified herein.

1. Floating Gymnasium Flooring.
2. Sprung Dance Wood Flooring.
3. Sprung Stage Wood Flooring.

1.3 SUBMITTALS

A. Product Data: Submit complete manufacturer's product data for each flooring system, including manufacturer's specific information for floor systems, including slip resistance and loading capability for installation for use as intended.

B. Signed and Sealed Calculations prepared by a Registered Engineer for floor load distribution panels.

C. Game Line Painting Certification: Submit certification that the installer has verified and will install playing line layouts in accordance with the current requirements of the applicable athletic regulating association.

D. Shop Drawings: Submit complete shop drawings showing details, connections, and layout of wood floor.

E. Samples of specified flooring complete with sealer, finish, base and accessories shall be submitted.

F. Pre-Construction Minutes: Submit pre-conference notes as herein indicated.

G. Warranty: Submit warranty as specified herein.

1.4 QUALITY ASSURANCE

A. The Work herein specified shall be carried out by an experienced wood flooring contractor and a member of the Wood and Synthetic Flooring Institute.

B. Wood Certifications: Each bundle of hardwood flooring shall be clearly marked with the required MFMA grades, and each piece shall be indented on its back side with the MFMA trademark.

C. Floor system to be floating floor type.

D. Pre-Construction Conferences

1. Prior to installation of flooring, Installer shall meet with Architect and Contractor on site to review and discuss procedures to be followed.
2. Agenda shall include temperature and humidity control, and protection during construction.

E. Source Limitations: Unless specifically noted otherwise, provide products of the same manufacturer for each type of unit.

1.5 PROJECT CONDITIONS

A. The concrete sub-floors shall be installed and finished under Section 03 30 00, to accommodate the wood floor, and finished with a steel troweled surface to floor levelness and floor flatness tolerances specified in Section 03 30 00.

B. Sub-floors shall be dry, free from foreign material and broom clean, are essential. Moderate room temperatures of 65 degrees or more are necessary. Areas should be free from other trades, scaffolding, and equipment of other contractors.

C. Starting application of wood flooring shall constitute acceptance, under this Section, that the subfloor surface is in proper condition and at correct elevation.

D. Specified items shall not be delivered or installed until building is enclosed, wet work completed and HVAC system is operating and maintaining temperature and humidity at occupancy level during remainder of construction period.

1. Conditioning

a. Maintain relative humidity conditions planned for building occupants, but not greater or less than relative humidity range of 35 to 50 percent, and ambient temperature between 55 and 75 deg F in space to receive wood flooring for at least seven days before installation.
b. Open sealed packages to allow wood flooring to acclimatize to the premises for a minimum of seven days.
c. Close spaces to traffic during flooring installation and after installation as recommended by flooring manufacturer, but not less than ten days.

E. At time of installation, moisture content of wood components shall test less than 7-10 percent and have been allowed to acclimate within the space to receive flooring for at least 3-14 days, depending on season and environmental conditions.

1.6 WARRANTY

A. Manufacturer’s Warranty for wood athletic flooring shall extend for five (5) years and cover manufacturing defects and MFMA grading certification.

B. Installer's Warranty

1. Provide 2-year warranty signed jointly by the Contractor and Installer covering materials, workmanship, installation and satisfactory performance of the wood athletic flooring.
2. Warranty shall also certify that flooring was installed in accordance with manufacturer's instructions for floor system specified.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Floor system shall have passed the requirements of DIN 18032, Part II as set out below.

1. Ball Rebound: 90%, minimum for gymnasium.
2. Shock Absorption: 53%, minimum for gymnasium.
3. Rolling Load: pass/fail for gymnasium.
4. Shock Absorption: 62% for Dance Studio.
5. Deformation: 2.6 mm for Dance Studio.

2.2 MANUFACTURERS

A. Floating Gymnasium Flooring.

1. Basis of Design Product and Manufacturer; as indicated on the Finish Schedule, subject to compliance with requirements other acceptable Manufacturers are:

    a. Aacer Flooring.
    b. Action Floor Systems.
    c. Connor Sports Flooring Corp.
    d. Horner Flooring Co.
    e. Robbins Sports Surfaces.

2. Finishing (Shall be Oil-Based):

    a. Players Choice 450 Basic Coatings.
    b. "Bona Sport System," BoneKemi USA, Inc.
    c. Polo Plaz National Coatings Company World Class 450.

3. Vapor Barrier: 10-mil thick polyethylene sheeting.
4. Cushioning Pads: 3/4-inch thick by 2-1/4-inches wide by 3 inches long rubber.
5. Subflooring: 2 layers of 15/32-inch thick APA CDX rated plywood, 4 by 8 foot sheets minimum 4-ply.
6. Wood Flooring: 25/32-inch thick by 2-1/4-inch wide kiln-dried, continuous tongue and groove and end-matched, steel knife face polished, mixed grain Northern Hard Maple, MFMA grade and trademarked. Use third grade flooring or better wood.
7. Base: 4-inch x 3-inch x 4-foot heavy duty molded, vented rubber or vinyl cove base with pre-molded outside corners as supplied by flooring manufacturer. Color as selected by the Architect.
8. Fasteners:

    a. Flooring: 1-3/4-inch barbed cleats or equivalent.

b. Subfloor: 1-1/2-inch – 1-5/8-inch subfloor nails.

9. Sealer (Group 1) and Finish (Group 3) system and materials shall be selected from the most recent listing of MFMA tested and certified for oil-modified urethane products as a designated system. Finish shall have a minimum 45% solids content.
10. Re-coat Finish shall be oil-modified urethane (Group 3) finish compatible with original sealer and finish system.

B. Sprung Dance Studio Flooring

1. Basis of Design Product and Manufacturer; as indicated on the Finish Schedule, subject to compliance with requirements other acceptable Manufacturers are:

a. Entertainment Flooring Systems.
b. iWeiss Theatrical Solutions.

2. Face: Maple face, engineered hardwood core compressed with water resistant phenolic resins yielding void free density of 41.3 lb/cf, cross band reinforced.
3. Suspension: Synthetic, closed cell, cellular urethane, 3/4 inch thick, (length, width, and pattern of placement as engineered by manufacturer), Dual-Durometer, combined low and high modulus. Flammability burn rate (inches per minute) = 0.
4. Finish Covering:

a. Prefinished hardwood surface, thickness: 0.75 inch.

1) Color: Match Architect's sample.

5. Floor panel sizes: 1.125m x 2.250m.
6. Dance surface size - 1.089m x 2.214m.
7. Minimum floor thickness (before inclusion of chosen finish) - 37mm.
8. Edge Trim, Skirting Profile: "P" rubber /polyurethane composite extrusion 4 inches high with 1 inch toe.

a. Color: As selected by Architect from Manufacturers full range.

C. Sprung Stage Flooring

1. Basis of Design Product and Manufacturer; as indicated on the Finish Schedule, subject to compliance with requirements other acceptable Manufacturers are:

a. Entertainment Flooring Systems.
b. iWeiss Theatrical Solutions.

2. Face: Maple face, engineered hardwood core compressed with water resistant phenolic resins yielding void free density of 41.3 lb/cf, cross band reinforced.
3. Suspension: Synthetic, closed cell, cellular urethane, 3/4 inch thick, (length, width, and pattern of placement as engineered by manufacturer), Dual-Durometer, combined low and high modulus. Flammability burn rate (inches per minute) = 0.
4. Finish:

a. Prefinished hardwood surface, thickness: 0.75 inch.

1) Color: Black.

5. Floor panel sizes: 1.125m x 2.250m.
6. Dance surface size - 1.089m x 2.214m.
7. Minimum floor thickness (before inclusion of chosen finish) - 37mm.
8. Base: 4-inch x 3-inch x 4-foot heavy duty molded, vented rubber or vinyl cove base with pre-molded outside corners as supplied by flooring manufacturer. Color as selected by the Architect.
9. Edge Trim, Skirting Profile: "P" rubber /polyurethane composite extrusion 4 inches high with 1 inch toe.

    a. Color: As selected by Architect from Manufacturers full range.

PART 3 - EXECUTION

3.1 INSPECTION

A. Concrete subfloor shall be instrument checked by Flooring Contractor and discrepancies reported to General Contractor for correction.

1. Do not proceed until corrections are made and approved.

B. Verify that Shop Drawings have been successfully submitted, reviewed and returned.

C. Verify required concrete slab recesses are to the correct depth and that slab is smooth and level to within an allowed tolerance of 1/8” in 10’. Installation of wood athletic flooring shall not proceed until slab is in acceptable condition.

D. Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

E. Inspect materials or equipment immediately upon delivery and again before installation. Reject damaged and defective items.

3.2 INSTALLATION

A. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

B. Gymnasium:

1. Install vapor barrier over concrete slab, lap and seal seams to provide a continuous membrane. Take care not to puncture or damage vapor barrier membrane. Lap joints minimum 6 inches.

    a. Run vapor barrier up sides of floor depression and seal at top edge with continuous bead of high grade mildew resistant silicone sealant.

2. Install resilient pads in quantities and at locations as instructed by the floor system manufacturer. In no case shall there be less than 32 pads attached to each 4 by 8 foot sheet of lower subflooring. Resilient attached pads shall be by nails or staples; adhesive attachment of resilient pads is not allowed.

3. Install first layer of plywood subflooring perpendicular to the intended finish flooring direction, spacing edges ¼ inch apart and placing joints at full stagger.
4. Install second layer of plywood subflooring at 45 degree diagonal direction to first layer. Space edges ¼ inch apart, place joints at full stagger, and attach with approved one inch long fasteners at 6 inches o.c. for panel perimeter and 12 inches o.c. for interior.
5. Nail finish wood flooring into second subfloor layer with boards running parallel to main playing court and with end joints tightly driven up. Provide suitable expansion spaces at regular intervals across flooring surface as fully agreed upon at jobsite preinstallation meeting between flooring subcontractor, flooring system manufacturer's representative, and Architect. Fasteners must have system manufacturer's approval.
6. Allow a continuous 2 inch wide expansion gap at meetings of flooring system with walls and other permanent vertical obstructions.
7. Install metal cover plates at door openings at edge of wood floor.
8. Affix vented base to walls with appropriate cement. Use premolded outside corners and neatly miter at inside corners.
9. Omit installation of cove base immediately behind bleacher stack area to provide maximum ventilation.
10. Install metal cover plates at edge of hardwood flooring that does not abut wall intersections.

C. Stage and Dance Flooring

1. Install vapor barrier over concrete slab, lap and seal seams to provide a continuous membrane. Take care not to puncture or damage vapor barrier membrane. Lap joints minimum 6 inches.

    a. Run vapor barrier up sides of floor depression and seal at top edge with continuous bead of high grade mildew resistant silicone sealant.

2. Install flooring panels and finish materials in accordance with Manufacturers requirements.

3.3 GYMNASIUM FLOOR SANDING AND FINISHING

A. Sand flooring and with drum sander, edger, buffer, and hand scraper.

1. Use coarse, medium, and fine grade sandpaper.
2. After final sanding with drum sander, buff entire floor using 100 grit screenback or equal sandpaper with a heavy duty buffing machine.
3. Vacuum floor before first coat of finish.
4. Floor shall present a smooth surface without drum stop marks, gauges, streaks, or shiners.

B. Finishing:

1. Apply sealer per manufacturer's application instructions.
2. Mark game lines with game line paint and let dry at least 13 hours. Prepare surfaces to receive finish coats.
3. Game lines shall be laid out in accordance with Drawings and current rules of Athletic Association having jurisdiction. Lines shall be straight with sharp edges of colors selected by Architect.
4. Apply a uniform coat of floor finish. Let dry at least 12 hours, then scour lightly with #2 steel wool; clean floor thoroughly and allow to dry. Apply second coat of floor finish and let cure for at least 7 days before permitting floor usage.

5. Game line paint shall be as recommended by the manufacturer if different than specified; game line paint shall be compatible with the finish coats.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 09 64 66

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SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Basis of Design Product and Manufacturer: Refer to Finish Schedule.

1. Subject to requirement, other manufacturers offering products which may be incorporated into the work are but not limited to the following:

a. Armstrong World Industries, Inc.
b. Mercer Products Co.
c. Johnsonite; a Tarkett company.
d. Roppe Corporation, USA.

B. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style and Location:

a. Style B, Cove.

C. Minimum Thickness: 0.125 inch.

D. Height: As indicated on the Finish Schedule.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Preformed.

H. Colors and Patterns: As indicated on the Finish Schedule.

2.2 RESILIENT MOLDING ACCESSORY

A. Basis of Design Product and Manufacturer: Refer to Finish Schedule.

1. Subject to requirement, other manufacturers offering products which may be incorporated into the work are but not limited to the following:

a. Armstrong World Industries, Inc.
a. Burke Mercer Flooring Products; a division of Burke Industries Inc.
b. Roppe Corporation, USA.

B. Profile and Dimensions: As indicated.

C. Locations: Provide vinyl molding accessories in areas indicated.

D. Colors and Patterns: As indicated on the Finish Schedule.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

C. Metal Edge Strips: Extruded aluminum with mill finish, nominal 2 inches wide, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09 65 13

SECTION 09 65 19
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient tile flooring.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: For each type of resilient floor tile.

1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Initial Selection: For each type of floor tile indicated.

D. Samples for Verification: Full-size units of each color and pattern of floor tile required.

E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 degrees F or more than 95 degrees F, in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 degrees F or more than 95 degrees F.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 VINYL COMPOSITION FLOOR TILE

A. Basis of Design Product and Manufacturer; As Indicated on the Finish Schedule, or subject to compliance with requirements, a comparable product by one of the following:

1. Forbo Industries, Inc.
2. Johnsonite; a Tarkett Company.
3. Roppe Corporation, USA.

B. Wearing Surface: As selected by Architect from Manufacturers full range.

C. Thickness: As Indicated on the Finish Schedule.

D. Size: As Indicated on the Finish Schedule.

E. Fire-Test-Response Characteristics:

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement-based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in direction as approved by the Architect.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply three coat(s).

E. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

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SECTION 09 65 40
LUXURY VINYL TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Luxury Vinyl Tile

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of flooring.

1. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Initial Selection: For each type of flooring indicated, and metal edge strips in 6-inch lengths.

D. Samples for Verification: For each type of flooring indicated, and metal edge strips in 6-inch lengths.

E. Product Schedule: For flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for flooring installation and seaming methods indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by flooring manufacturer for installation techniques required.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F or more than 90 deg F.

1. Floor Tile: Store on flat surfaces.
2. Sheet Flooring: Store rolls upright.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring during the following periods:

1. 72 hours before installation.
2. During installation.
3. 72 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during flooring installation.

D. Close spaces to traffic for 72 hours after flooring installation.

E. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 LUXURY VINYL TILE

A. Basis of Design Product and Manufacturer; As Indicated on the Finish Schedule, subject to compliance with requirements other Manufacturers offering products which may be incorporated into the work are but not limited to the following:

1. Armstrong World Industries.
2. Mohawk Flooring.
3. Shaw Floors.
4. Tandus Centiva.

a. Thickness: As indicated on the Finish Schedule.
b. Wearing Surface: As selected by Architect from Manufacturer's full range of textures.
c. Colors and Patterns: As indicated on the Finish Schedule.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor plank manufacturer for applications indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, stainless steel; ASTM A 666, 300 Series exposed-edge material.

1. Basis of Design Product and Manufacturer; As Indicated on the Finish Schedule.

C. Adhesives: Water-resistant type recommended by floor plank and adhesive manufacturers to suit floor plank and substrate conditions indicated.

PART 3 - EXECUTION

A. Prepare substrates according to floor plank manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor plank manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor plank manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor plank manufacturer's written recommendations, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor planks until they are the same temperature as the space where they are to be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor plank.

3.2 FLOOR PLANK INSTALLATION

A. Comply with manufacturer's written instructions for installing floor plank.

B. Lay out floor planks from center marks established with principal walls, discounting minor offsets, so planks at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half plank at perimeter.

1. Lay planks in pattern indicated.

C. Match floor planks for color and pattern by selecting planks from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed planks.

1. Lay planks in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor planks to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor planks into toe spaces, door reveals, closets, and similar openings. Extend floor planks to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor planks as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor planks on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of plank installed on covers and adjoining planks. Tightly adhere plank edges to substrates that abut covers and to cover perimeters.

H. Adhere floor planks to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

I. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, vinyl, wood, or other flooring that finishes flush with top of tile.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor plank.

END OF SECTION 09 65 40

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SECTION 09 65 66
RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Rubber floor tile.
2. Rubber Sheet Flooring.

1.3 COORDINATION

A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details and locations of the following:

1. Border tiles.
2. Floor patterns.
3. Layout, colors, widths, and dimensions.
4. Locations of floor inserts for athletic equipment installed through flooring.

C. Samples: For each exposed product and for each type, color, and pattern specified, 6-inch-square in size and of the same thickness indicated for the Work.

D. Samples for Initial Selection: For each type of resilient athletic flooring.

E. Samples for Verification: For each type, color, and pattern of flooring specified, 6-inch- square in size and of same thickness and material indicated for the Work.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resilient athletic flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish no fewer than 1 box for each 50 boxes or fraction thereof, of each type, color, pattern, and size of floor tile installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.

B. Store materials to prevent deterioration.

1. Store tiles on flat surfaces.
2. Store rolls upright.

1.8 FIELD CONDITIONS

A. Adhesively Applied Products:

1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
3. Close spaces to traffic during flooring installation.
4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.

B. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RUBBER FLOOR TILE

A. Basis of design Product and Manufacturer, as indicated on the Finish Schedule, or subject to compliance with requirements, other available manufacturers offering products that may be incorporated into the Work include:

1. AFCO
2. Burke
3. Gerflor USA.
4. Regupol America.
5. Sport Court.

B. Description: Athletic flooring consisting of modular rubber tiles with precision cut, square edges, for adhered installation.

C. Material: Recycled-rubber compound.

D. Traffic-Surface Texture: Nondirectional, stipple texture.

E. Size: As indicated.

F. Thickness: As indicated.

G. Color and Pattern: As selected by Architect from manufacturer's full range.

H. Border: Interlocking, beveled-edge tiles, of same material as floor tile; with bevels that transition from thickness of floor tile to surface below it; with straight outside edges; for use where flooring corners and edges do not abut vertical surfaces.

1. Border Color and Pattern: As selected by Architect from manufacturer's full range to contrast with floor tile.

2.2 RUBBER SHEET FLOORING

A. Basis of design Product and Manufacturer, as indicated on the Finish Schedule, or subject to compliance with requirements, other available manufacturers offering products that may be incorporated into the Work include:

1. AFCO
2. Burke
3. Gerflor USA.
4. Regupol America.
5. Sport Court.

B. Description: Athletic flooring consisting of rubber sheet, for adhered installation.

C. Material: Recycled-rubber compound.

D. Traffic-Surface Texture: Nondirectional, stipple texture.

E. Size: As indicated.

F. Thickness: As indicated.

G. Color and Pattern: As selected by Architect from manufacturer's full range.

H. Border: Interlocking, beveled-edge tiles, of same material as floor tile; with bevels that transition from thickness of floor tile to surface below it; with straight outside edges; for use where flooring corners and edges do not abut vertical surfaces.

1. Border Color and Pattern: As selected by Architect from manufacturer's full range to contrast with floor tile.

2.3 ACCESSORIES

A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

B. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.
3. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.

1. Do not install flooring until it is the same temperature as space where it is to be installed.

F. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 FLOORING INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

3.4 FLOOR TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

B. Discard broken, cracked, chipped, or deformed tiles.

C. Tile Matching: Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged if so numbered.

1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

D. Adhered Floor Tile: Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.5 FIELD-APPLIED FINISHES

A. Apply finish according to manufacturer's written instructions to produce a sealed surface that is ready for use.

B. Do not cover flooring after finishing until finish reaches full cure.

3.6 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing flooring installation:

1. Remove adhesive and other blemishes from flooring surfaces.
2. Sweep and vacuum flooring thoroughly.
3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.

B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09 65 66

SECTION 09 68 00
CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes carpeting and accessories.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpeting installation including, but not limited to, the following:

    a. Review delivery, storage, and handling procedures.
    b. Review ambient conditions and ventilation procedures.
    c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpeting installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpeting.
2. Carpeting type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples for Initial Selection: For each type of carpeting.

1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.

D. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpeting: 24” x 24” Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

E. Product Schedule: For carpeting. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpeting, for tests performed by a qualified testing agency.

1. Smoke and flammability reports

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpeting to include in maintenance manuals. Include the following:

1. Methods for maintaining carpeting, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpeting.

B. Video recording of instruction class for the Owner’s maintenance staff.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpeting: Full-size units equal to 10 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.8 QUALITY ASSURANCE

A. Contractor’s Qualifications:

1. Employ only experienced installers, skilled in installation of the specified systems.
2. Installation company shall employ a minimum of three qualified installers with a minimum of three years experience each of installing similar systems.

B. Manufacturer’s Qualifications:

1. Employ only manufacturers making the specified materials as a current production item.
2. Manufacturers shall have a minimum of five years of production experience with carpet of similar types to that specified.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups at locations and in sizes shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Source Limitations: Obtain carpet from a single source, unless otherwise directed by Architect.

E. Carpet shall have been tested against and passed the Indoor Air Quality Carpet Testing Program requirements of CRI.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI's "CRI Carpet Installation Standard."

B. Deliver materials in the original factory packaging, labeled with identification of manufacturer, brand name, lot number, and test data.

C. Store materials on site, in original packaging, inside a well-ventilated area protected from weather, moisture, soilage, extreme temperatures, and humidity.

1.10 FIELD CONDITIONS

A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpeting until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpeting over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpeting manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpeting, install carpeting before installing these items.

1.11 PROJECT CONDITIONS

A. Dimensions supplied in these Specifications and Drawings are approximate. Field verify dimensions and other conditions affecting Work.

1.12 WARRANTIES

A. Manufacturer's Warranty: Non-pro-rated, not less than 15 year warranty against surface pile wear, zippering, edge ravel, excessive static, loss of resiliency, moisture barrier, and delamination of secondary backing.

B. Installer's Warranty: Guarantee installation against defects in workmanship, seaming, and loss of adhesion for not less than 3 years from Date of Substantial Completion.

C. Warranties shall begin on the date of Substantial Completion.

D. Upon written notice from the Architect, correct or replace improper work and material that may become apparent within the warranty period. Repairs will be made in accordance with this specification.

1. Exception: Any problems arising from improper adherence to the manufacturer's recommended maintenance program.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Carpeting shall have a minimum critical radiant flux of 0.45 watts per square centimeter (radiant panel test) per ASTM E-648 "Standard Test Methods for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source", latest edition.

B. Carpet Fire-Test-Response Characteristics: Provide carpeting with the following characteristics as determined by testing identical products per test method indicated below by U.L. or another nationally recognized testing laboratory acceptable to the authorities having jurisdiction. Identify carpet with appropriate markings of applicable agency.

1. Surface Flammability: Passes CPSC 16 CFR, Part 1630
2. Flame Spread 25 or less per ASTM E 84, latest edition
3. Smoke Development: 450 or less per ASTM E 84, latest edition
4. Static: Under 3.5 kv. Below the average level of human sensitivity

C. Dry Breaking Strength: Not less than 100 lbf according to ASTM D 2646.

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, as indicated on the Finish Schedule, or a comparable product by one of the following:

1. Interface, LLC.
2. Milliken & Company.
3. Tandus; a Tarkett company.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpeting manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpeting, and are recommended by carpeting manufacturer for releasable installation.

C. Vinyl Carpet Trims: Products and colors shall be as selected by Architect from available products and accessories similar to those manufactured by Johnsonite.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpeting performance.

B. Examine carpeting for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI's "Carpet Installation Standards" and with carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpeting.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpeting.

3.3 INSTALLATION

A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet manufacturer's written installation instructions.

B. Installation Method: Glue down; install with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns, match mock-up.

E. Cut and fit carpeting to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, and thresholds. Bind or seal cut edges as recommended by carpet manufacturer.

F. Extend carpeting into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpeting as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

I. Separate waste in accordance with the Waste Management Plan. Manufacturer to reclaim all scrap not retained by Owner.

3.4 CLEANING AND PROTECTION

A. All scrap carpet shall be palletized and returned to the manufacturer.

B. Immediately after installation, remove visible cement, dirt, wrappings, cartons, clippings, and other foreign substances. Vacuum carpet.

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpeting surface.
3. Vacuum carpeting using commercial machine with face-beater element.

C. Protect installed carpeting to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."

D. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and installer until the Date of Substantial Completion.

E. Conduct an instruction class for the Owner’s maintenance staff prior to the Date of Substantial Completion.

1. Instruct personnel on the proper method of cleaning the material as recommended by the manufacturer.
2. Videotape this session.

END OF SECTION 09 68 00

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SECTION 09 75 23
STONE WINDOW SILLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes marble windowsills.

1.3 SUBMITTALS

A. Product data for each type of marble, marble accessory, and other manufactured products required.

B. Shop drawings detailing fabrication and installation of marble. Include cutting and setting drawings indicating sizes, dimensions, and sections; arrangement and provisions for jointing, supporting, anchoring, and bonding stonework; and details showing relationship with, attachment to, and reception of related work.

C. Samples for verification purposes of marble in form of sets for each color, grade, finish, type, and variety required and consisting of marble not less than 12 inches square. Include 2 in each set of samples showing the full range of variations in appearance characteristics to be expected in completed work.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility for marble: Obtain each color, grade, finish, type, and variety of stone from a single quarry with resources to provide materials of consistent quality in appearance and physical properties, including the capacity to cut and finish material without delaying the progress of the work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project Site in undamaged condition.

B. Store and handle stone and related materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breakage, chipping, or other causes.

1. Do not use pinch or wrecking bars.
2. Store stone on wood skids or pallets covered with nonstaining, waterproof membrane. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking of stones.

3. Protect stored stone from weather with waterproof, nonstaining covers or enclosures, but allow air to circulate around stones.
4. Store cementitious materials off the ground, under cover, and in dry location.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Comply with referenced standards and other requirements indicated applicable to each type of material required.

B. Provide matched marble from a single quarry for each type, variety, color, and quality of stone required.

2.2 MARBLE

A. "Alabama" as manufactured by the Georgia Marble Dimension Stone, Polycor, Inc., Tate, Georgia. The following are approved manufacturers: (Equal products are at the approval of the Architect by the following manufacturers. Other manufacturers shall submit request for product approval at least 10 days prior to bid due date.)

1. Amlink Marble, Ypsilanti, Michigan
2. Central Marble Products, Rice, Minnesota
3. "Pure White Thazoz" by StonExchange, Miami, Florida.

B. Physical Properties: per ASTM C503:

1. Absorption by weight, % 0.09
2. Density, lb/cu.ft 169
3. Compressive strength, PSI 9333
4. Modulus of rupture, PSI 1364
5. Abrasion resistance, hardness 16.6
6. Flexural strength, PSI 1296

2.3 ANCHORS AND ATTACHMENTS

A. Provide anchors and attachments of type and size required to support dimension stonework and fabricated from the following metals for conditions and anchors indicated below:

1. Stainless Steel: ASTM A666, AISI Type 304, temper as required to support loads imposed without exceeding allowable design stresses, for anchors in direct contact with stone and the fasteners connecting them to other anchors and to building structure.

2.4 DIMENSION STONE FABRICATION

A. General: Fabricate dimension stonework in sizes and shapes required to comply with requirements indicated, including details on Drawings and final shop drawings.

1. For marble comply with recommendations of Marble Institute of America, Inc. (MIA) as published in "Dimensional Stone - Design Manual III."

B. Cut stones to produce pieces of thickness, size, and shape indicated to comply with fabrication and construction tolerances recommended by applicable stone association or, if none, by stone source, for faces, edges, beds, and backs.

C. Finish exposed faces and edges of stones to comply with requirements indicated for finish under each type and application of stone required and to match approved samples and field-constructed mock-ups.

D. Carefully inspect finished stones at fabrication plant for compliance with requirements relative to qualities of appearance, material, and fabrication; replace defective stones with ones that do comply.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive marble, and conditions under which marble will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of dimension stonework. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. All materials used in installation of marble shall be installed in accordance with the manufacturer's requirements.

B. Installation shall be in accordance with the Drawings, reviewed shop drawings, and manufacturers recommendations.

3.3 CLEANING

A. After completion of work, all marble surfaces shall be carefully cleaned to remove dirt, stains, or other defacements. Under no circumstances shall wire brushes, harsh abrasive cleansers or acid be used to clean marble.

3.4 PROTECTION

A. Protect and maintain conditions in a manner acceptable to Fabricator and Installer to ensure stonework is not damaged at time of Substantial Completion.

END OF SECTION 09 75 23

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SECTION 09 84 10
ACOUSTICAL METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY OF WORK

A. Section includes a prefinished metal panel system, sound absorbing fill material, metal furring and closures with miscellaneous accessories and fasteners as indicated on the Drawings and specified herein.

1.3 REFERENCES

A. The following publications form a part of this specification to the extent as referenced herein.

B. American Society for Testing and Materials (ASTM)

1. NRC Test as per ASTM C423: Type “A” mounting.

1.4 SUBMITTALS

A. Product Data: Submit 6 each of manufacturer’s product catalog data and color charts.

B. Samples: 2 samples each of 12 inch x 12 inch panels, bafs, furring and trim sections.

1.5 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Designed and fabricated by manufacturer with a minimum five (5) years producing metal acoustic panels similar to those required for this project.

B. Installer’s Qualifications: Manufacturer's authorized installer for single source responsibility.

C. The Acoustical Panels and Bafs shall meet the requirements of Federal Specification SS-S-118B.

D. Fire Rating - All Components: Underwriters' Laboratories rated; and not exceed the following ratings when tested in accordance with ASTM E84:

1. Flame Spread: 25 for a class “A” rating.
2. Fuel Contributed: 20.
3. Smoke Developed: 25.

E. Performance Requirements: Tested by an independent acoustic laboratory; meet or exceed the following properties:

1. ASTM C423 - Sound Absorption Coefficient, dB

Octave Band, Hz	125	250	500	1000	2000	4000	NRC
2" thick absorptive panels	0.57	0.86	1.15	1.07	0.94	0.82	0.95

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unopened containers or packaging bearing product and manufacturer's identification.

B. Store panels horizontally in clean, dry storage area. Handle to prevent soiling, wetting and damage.

1.7 PROJECT CONDITIONS

A. Do not install metal acoustic panels until spaces are completely weathertight and finish painting is completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Drawings and Specifications are based on the system ALPRO pattern type “F” as manufactured by ALPRO Acoustics Inc.

B. Other manufacturers as an “EQUAL” product to the ALPRO system.

2.2 MATERIALS

A. System: ALPRO pattern “F”, 2 inch thick panels with 2 inches of sound retarding and absorbing fill. The Designer Metal Appliqué Panels will be ALPRO “Flat Baf.” All as required to meet Performance Requirements specified herein.

1. Acoustical Panels and Bafs: Formed from single 24 gauge G-90 galvanized unembossed, perforated sheet steel; perforations to be approximately 1/8 inch diameter openings spaced evenly at 21/64 inch staggered centers.

2. Panels shall be 48 ¼ inches wide (47 inches when lapped) x cut lengths to 144 inches as shown on Drawings.
3. Bafs shall be custom fabricated to the dimension shown on the drawings.
4. Sound Absorbing Fill: Manufacturer's standard, unwrapped fiberglass sound absorbing pad, 2 inches x 24 inches x 48 inches with 1 ½ lb / cu. ft. density as supplied with panel system. The material's (NRC) shall be 1.00
5. Internal Panel Reinforcements: "Z" furring shall be 26 gauge G-90 galvanized steel, nonperforated, 1 ½ inches x 2 inches x 1 inch x 120 inches and factory finished to match panels. "J" trim shall be 26 gauge G-90 galvanized steel, non-perforated, 1 inch x 2 ¾ inches x 1 ½ inches and shall be finished to match panels

B. Finish: The Panels and related components shall receive a chemical conversion coat before receiving an electrostatically applied epoxy or polyester powder coat finish. Finish is to be cured and baked dried in gas fired convection ovens to insure proper paint adhesion and uniform surface hardness.

1. Panels and Bafs are to be powder coated after perforation process to insure proper coverage and protection of the perforation perimeters.
2. Colors: ALPRO's Standard and / or Custom Finishes, as selected by Architect.

C. Accessories: As recommended by manufacturer for complete installation. Include electrical device mounting accessories. Exposed fasteners shall match the panel finish.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine substrate surfaces and the conditions under which the work of this section is to be performed. Notify General Contractor of defects and unsatisfactory conditions before beginning installation. Starting installation work indicates acceptance of substrate surfaces.

3.2 INSTALLATION

A. General

1. Installation to be in strict accordance with manufacturer's written instructions, recommendations, and approved shop drawings.
2. Field measure existing conditions to establish the exact layout of the system as indicated on the drawings.

B. "Z" furring is to be installed horizontally 24 inches o.c. in all wall panel sections.

C. "J" trim is to be installed both vertically and horizontally at perimeters of all metal wall sections.

D. Sound Pad is to be installed horizontally between the "Z" furring.

E. Metal panels are to be installed over "Z" furring and sound pads with the corrugation running vertically. Where two or more panels are installed in a metal wall section, the vertical edges of panels are to be lapped one corrugation.

F. Fasten panels to “Z” furring 24 inches o.c. both vertically and horizontally with pre-painted 1 inch #8 tek screw or pan head Phillips screw. Field painting of screws is unacceptable except for final touch-up conditions.

G. Fasten “J” trim to panel with 1 inch #8 tek screws 24 inches o.c. horizontally.

H. Mount Designer Applique Panels with secure attachments to the Metal Acoustical Panels as recommended by the manufacturer.

I. Touch-up exposed screw heads and incidental panel scratches with paint matching panel color.

3.3 ADJUST AND CLEAN

A. Clean exposed surfaces of panels. Touch-up minor scratches, abrasions; repair minor defects. Replace panels damaged that cannot be successfully repaired to the satisfaction of the Construction Manager. Provide protective measures as required to insure that work of this section will be without damage or deterioration at Date of Substantial Completion.

END OF SECTION 09 84 10

SECTION 09 84 13
FIXED SOUND PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:

1. Fabric covered sound-absorbing wall panels.
2. Wood Panels sound-absorbing wall units.
3. Geometric sound-diffusing wall and ceiling panels.

1.3 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include each type of panel facing, panel edge, core material, and mounting indicated.

B. Shop Drawings: For unit assembly and installation.

1. Include plans, elevations, sections, and mounting devices and details.
2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
3. Include details at cutouts and penetrations for other work.
4. Include direction of fabric weave and pattern matching.

C. Samples for Initial Selection: For each type of panel fabric and wood facing.

1. Include Samples of hardware and accessories involving color or finish selection.

D. Samples for Verification: For the following products:

1. Fabric: Full-width by approximately 36-inch- long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
2. Wood Panels: 24-inch x 24-inch Sample, with edge condition and panel reveal, showing panel and cut.
3. Panel Edge: 12-inch-long Sample(s) showing each edge profile, corner, and finish.
4. Core Material: 12-inch-square Sample at corner.
5. Mounting Devices: Full-size Samples.
6. Assembled Panels for fabric and wood: Approximately 36 by 36 inches, including joints and mounting methods.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets, switches, and thermostats.
2. Items penetrating or covered by units including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Alarms.
    e. Sprinklers.
    f. Access panels.

3. Show operation of hinged and sliding components covered by or adjacent to units.

B. Product Certificates: For each type of unit.

C. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.8 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials, fabrication, and installation.

1. Build mockup of typical wall area 72 inches wide by full height. Include intersection of wall and ceiling, corners, panel edge and perimeters.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.

C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to the following:

a. Acoustical performance.
b. Fabric sagging, distorting, or releasing from panel edge.
c. Wood facing, delaminating.
d. Warping of core.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.2 MANUFACTURERS

A. Basis-of-Design Manufacturer; G&S Acoustic (Golterman & Sabo), subject to compliance with requirements, other manufacturers offering products which may be incorporated into the work are but not limited to the following:

1. AVL Systems, Inc.
2. CertainTeed Ceilings
3. Conwed Plastics
4. Kinetic Noise Control.
5. Lamvin, Inc.
6. Perdue Acoustics
7. SoundSeal
8. Wenger Corporation

2.3 FABRIC FACED SOUND-ABSORBING WALL UNITS

A. Basis-of-Design Product: As indicated on the Finish Schedule.

2.4 WOOD FACED SOUND-ABSORBING WALL UNITS

A. Basis of Design Product and Manufacturer; as indicated on the AVL Systems, Model Tone Wood 12/4 Type A mounting; Subject to compliance with requirements, other available manufacturers offering products that may be incorporated into the Work include the following:

1. Kinetics Noise Control.

B. Panels shall be backed with 1” Theaterblack backing.

C. Acoustical Performance: tested per ASTM C-423 with the finished system, panels and fiberglass, mounted directly (Type A mounting) shall have a Noise Reduction Coefficient (NRC) of 0.90, 1 inch fiberglass. Panel sizes as shown on drawings, maximum size is 4’ x 8’.

1. Core: Fire Rated FRP or Fire Rated MDF.
2. Thickness: ¾”
3. Groove Spacing: 5/16”.
4. Facing: Wood Veneer.

a. Finish: As indicated on the Finish Schedule.

D. Edge Finish Options: Stain matching panel face.

E. Edge Profile: Square, locations as indicated.

2.5 GEOMETRIC SOUND-DIFFUSING WALL AND CEILING UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide SONEX classic equal to SONEX barrel, seamless coverage, Size as indicated on the drawings. Fire-retardant Class 2 Fire rated urethane, NRC 0.75 as manufactured by SONEX Acoustical Products.

B. Sound Diffusing Panel Types:

1. Drop-in Ceiling Panels:

a. Facing: None.

2. Wall Panels:

a. Facing: 100% polyester fabric, FR 701 Style 2100 by Guilford of Maine. No seams will be permitted in the fabric covering or exposed faces and edges.

1) Color: As indicated on the Finish Schedule.

b. Edge Detail: Square hardened with non-resin, Class A hardening solution.

3. Wall Attachment Devices and Systems: Zinc plated steel mechanical fasteners, slip joint type. Fastening devices are to be permanently attached to the back of the panels with fiberglass resin. Provide sufficient slip type to hold the panel flush to the wall.
4. Edge Profile: Chamfered (beveled) and Square, locations as indicated.
5. Reveals between Panels: Recessed and Flush reveals as selected by Architect from manufacturer's full range, locations as indicated.

2.6 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Edge Hardening: Chemically harden core edges and areas of core where mounting devices are attached.

C. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.

D. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.

1. Square Corners: Tailor corners.
2. Radius and Other Nonsquare Corners: Attach facing material so there are no seams or gathering of material.
3. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent units.

E. Dimensional Tolerances of Finished Units: Plus, or minus 1/16 inch for the following:

1. Thickness.

2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Align fabric pattern and grain with adjacent units.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch in 48 inches, noncumulative.

B. Variation of Joint Width: Not more than 1/16-inch variation from hairline in 48 inches, noncumulative.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 84 13

SECTION 09 84 16
SUSPENDED SOUND-REFLECTIVE PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:

1. Suspended sound-reflective panels.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop drawings shall indicate dimensioned layouts, plans and sections showing assembly and the installation of components.

1. Submit shop drawings to Structural Engineer of record for review and approval, in accordance with Division 1.
2. Individual components shall be detailed as required to illustrate materials, thicknesses, sizes and methods of assembly or attachment to adjoining components.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Panels 12-inch- square module Samples of each type, finish, and color.

E. Delegated-Design Submittal: For design of attachment and support devices.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting fixtures.

2. Air outlets and inlets.
3. Speakers.
4. Sprinklers.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Workmanship: All workmanship and finish must be first-class in every particular and strictly in accordance with the best practice. All work shall be made in accordance with the approved shop drawings. All work made in sections shall be properly laid out and spaced between terminals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design attachment and support devices.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.2 SOUND-REFLECTING CEILING UNITS

A. Sound-Reflecting Ceiling Panel: Manufacturer's standard panel construction consisting of laminate faced plywood panels with edges painted to match face.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Basis of Design: Ovation reflector panels as manufactured by Kinetics Noise Control, or a comparable product by one of the following:

a. AVL Systems, Inc.
b. Benton Brothers Solutions, Inc.
c. Conwed Designscape; an Owens Corning company.
d. Decoustics Limited; a Saint Gobain company.
e. Wenger Corporation.

2. Panel Shape: Curved panel.
3. Mounting: Back mounted with manufacturer's standard suspension system with stiffening, back-support angles, secured to substrate.

a. Color for Supports: Black.
b. Vertical support Rods: Zinc Plated.

4. Core: 3/4-inch plywood.
5. Facing; High-Pressure Decorative Laminate: NEMA LD 3, grade HGS.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Wilsonart; or a comparable product by one of the following:

        1) Formica Corporation.
        2) Lamin-Art, Inc.
        3) Pionite; a Panolam Industries International, Inc. brand.

    b. Color: As Selected by Architect from Manufacturers Standard colors.

2.3 ACCESSORIES

A. Aircraft Cable: Provide uncoated, commercial air craft cable, cable thimbles and cable clamps as required for support.

1. Thickness: 1/8-inch diameter minimum, and to meet performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify that substrate or supporting structure, which has been previously installed under other sections, is acceptable for product installation in accordance with manufacturer's instructions.

3.2 INSTALLATION

A. Consult and coordinate work with trades doing adjoining work.

B. Use fittings and clips conforming with cable manufacturer's recommendations as to size, number, and method of installation. Form rope and cable eyes over properly sized thimbles at requisite connection points.

C. Position items accurately as indicated on drawings and true to plumb line and level.

D. Provide completed installation, ready for satisfactory operation, prior to test and inspection. Advise the Architect in writing that the installation is completed and ready for acceptance tests and inspection.

E. Install in strict accordance with the manufacturer's written installation instructions.

F. Provide all items and accessories as required for a complete installation in every respect, whether or not indicated or specified.

END OF SECTION 09 84 16

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SECTION 09 84 36
SUSPENDED CEILING BAFFLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Suspended Ceiling Baffles.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include facing and mounting.

B. Shop Drawings: For unit assembly and installation.

1. Include reflected ceiling plans, elevations, sections, and mounting devices and details.
2. Include details at ceiling intersections and intersections with walls. Indicate panel edge profile and core materials.
3. Include direction of pattern and pattern matching.

C. Samples for Initial Selection: For each type of facing.

1. Include Samples of hardware and accessories involving color or finish selection.

D. Samples for Verification: For the following products:

1. Panel: Full-width by approximately 36-inch-long Sample.
2. Mounting Devices: Full-size Samples.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components above ceiling units.
2. Structural members to which suspension devices will be attached.
3. Items penetrating or covered by ceiling units including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Alarms.
    e. Sprinklers.
    f. Access panels.

4. Show operation of hinged and sliding components covered by or adjacent to units.

B. Product Certificates: For each type of unit.

C. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include manufacturer's written cleaning and stain-removal instructions.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials unopened and store in a temperature-controlled dry place with adequate air circulation.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.

C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

2.2 SUSPENDED CEILING BAFFLES

A. Suspended Baffles: Basis-of-Design Product and Manufacturer; as indicated on the Reflected Ceiling Plan, or a comparable product from one of the following:

1. AVL Systems, Inc.
2. Certainteed.
3. Conwed Designscape; and Owens Corning Company.
4. CSI Wall Panels.

B. Panel Shape: As indicated on the Reflected Ceiling Plan.

C. Mounting: Top-edge mounted with manufacturer's standard suspension system, secured to substrate.

D. Panel Height: Reflected Ceiling Plan.

E. Color: Match Architect’s sample.

F. Core: Manufacturer's standard.

2.3 MATERIALS

A. Mounting Devices: Concealed on back or top edge of unit, recommended by manufacturer to support weight of unit.

2.4 FABRICATION

A. Standard Construction: Use manufacturer's standard construction.

B. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units in locations indicated. Unless otherwise indicated, install units with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

A. Variation from Level or Slope: Plus or minus 1/8 inch.

3.4 CLEANING

A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 84 36

SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exposed exterior items and surfaces.
2. Exposed interior items and surfaces.
3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment installed and application of paint coats to all finish coated mechanical and electrical equipment in exterior locations, except as otherwise indicated.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

D. Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.3 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

1. After color selection, the Architect will furnish color chips for surfaces to be coated.

C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
3. On actual wall surfaces and other exterior and interior building components, duplicate painted finishes of prepared samples. On at least 100 square feet of surface, as directed, provide full-coat finish samples until required sheen level., color and texture is obtained; simulate finished lighting conditions for review of in-place work.

D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 ATTIC STOCK

A. Immediately prior to Final Completion, provide Owner with a voucher for 5 gallons of each color used for each coating material applied on the Project to purchase paint at later date.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 degrees F.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 degrees F.

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products and Manufacturers: Subject to compliance with requirements, products and manufacturers specified include, but are not limited to, the following:

1. The Sherwin-Williams Company

B. Other Products and Manufacturers: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:

1. Benjamin Moore & Company (Moore).
2. PPG Industries, Inc. (PPG).

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Provide color selections made by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

3.4 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 INTERIOR PAINT SCHEDULE

A. Concrete Masonry Units:

1. Acrylic Finish, two finish coats over block filler.

a. Block Filler: SW Heavy Duty Block Filler.
b. Second and Third Coats: SW Pro Industrial Multi-Surface Acrylic.
c. Sheen: See Finish Schedule.

B. Concrete Floors (Sealer): Sealed concrete.

1. Acrylic, clear. Two coats over prepared substrate.

a. Finish Coats: Groundworks 3214, Water-Based Clear Acrylic Concrete Sealer; Glidden Professional

C. Gypsum Board:

1. Acrylic, two finish coats over primer.

a. Primer: SW Promar 200 Zero VOC Latex Primer.
b. Second and Third Coats: SW Pro Industrial Multi-Surface Acrylic.
c. Sheen: See Finish Schedule.

2. Epoxy Finish: two finish coats over primer.

a. Primer: SW Promar 200 Zero VOC Latex Primer.
b. Second and Third Coats: Pro-Industrial water based Catalyzed Epoxy.
c. Sheen: See Finish Schedule.

D. Overhead Steel Structure:

1. Dryfall; two Finish Coats over Primer.

a. Finish Coats: 1-coat Tnemec Series 115 Uni-Bond.
b. Application: 2.0 - 4.0 DFT
c. Sheen: Semi-Gloss.

E. Ferrous Metal.

1. Epoxy Finish: Two finish coats over primer.

a. Primer: SW Pro Industrial Pro-Cryl Primer.
b. Second and Third Coats: Pro-Industrial water based Catalyzed Epoxy.
c. Sheen: Egg shell.

3.7 EXTERIOR PAINT SCHEDULE

A. Tilt-Up Concrete Walls, Cast-in-Place Concrete, Masonry and Cement Plaster: Provide the following finish systems over exterior concrete surfaces:

1. Primer: Applied at spreading rate recommended by manufacturer, but not less than the following:

a. Masonry (CMU): Tex-Cote Latex Blockfiller – DFT 10.0 – 16.2 mils DFT.
a. Concrete (including Tilt-Wall); TexCote Cool-Wall Textured Acrylic Primer – DFT 14.0 – 18.0. 50-60 sq. ft per gallon.

2. Second and Third Coats: Applied at spreading rate recommended by manufacturer, but not less than the following:

a. TexCote Supercote Heat Reflective Exterior Acrylic Satin Coating, DFT 3.0 – 4.0.

3. Colors Selection: As selected by Architect from Manufacturers full range.
4. Texture: As selected by Architect from Manufacturers full range.
5. Warranty: (10) ten Years.

B. Ferrous Metal, Primed and Unprimed:

1. Primer: Tnemac: Series 66 Polyamide Epoxy. 2.5 - 3.5 DFT.
2. Tnemac: Series 1095 Semi-Gloss Acrylic Polyurethane 2.5 - 3.5 DFT.

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Division 10

Specialties

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SECTION 10 11 00
VISUAL DISPLAY BOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of visual display boards:

1. Porcelain enamel markerboards.
2. Vinyl face tackboards.
3. Bulletin Boards.
4. Tack Strips.

1.3 SUBMITTALS

A. Product Data: Include motor capacities; and individual panel weights for markerboard units. Include manufacturer's data substantiating that tackboard materials comply with requirements indicated.

B. Shop Drawings: Provide shop drawings for each type of markerboard, and tackboard required. Include sections of typical trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

C. Samples: Provide the following samples of each product for initial selection of colors, patterns, and textures, as required, and for verification of compliance with requirements indicated.

1. Samples for initial selection of color, pattern, and texture:

a. Porcelain Enamel Markerboard: Manufacturer's color charts consisting of actual sections of porcelain enamel finish showing the full range of colors available for each type of markerboard required.
b. Vinyl faced Tackboards: Manufacturer's color charts consisting of actual sections of vinyl fabric, showing the full range of colors, textures, and patterns available for each type of vinyl-fabric-faced cork tackboard indicated.
c. Aluminum Trim and Accessories: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate, showing the full range of colors available.

2. Samples for verification of color, pattern, and texture selected, and compliance with requirements indicated.

a. Markerboards, and Tackboards: Sample panels not less than 8-1/2 inches by 11 inches for each type of chalkboard, markerboard, and tackboard indicated. Include a sample panel for each color, texture, and pattern required.
b. Aluminum Trim and Accessories: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate. Where finishes involve normal color and texture variations, include sets showing the full range of variations expected.

D. Certificates: In lieu of laboratory test reports, when permitted by the Architect, submit the manufacturer's certification that vinyl-fabric-faced cork tackboard materials furnished comply with requirements specified for flame spread ratings.

E. Submit warranties as specified herein.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who is an authorized representative of the markerboard manufacturer for both installation and maintenance of the type of chalkboard and markerboard units required for this Project.

1. Maintenance Proximity: Not more than 4 hours' normal travel time from the Installer's place of business to the Project site.

B. Fire Performance Characteristics: Provide vinyl-fabric-faced tackboards with surface burning characteristics indicated below, as determined by testing assembled materials composed of facings and backings identical to those required in this section, in accordance with ASTM E 84, by a testing organization acceptable to authorities having jurisdiction.

1. Flame Spread: 25 or less.
2. Smoke Developed: 10 or less.

C. Design Criteria: The drawings indicate sizes, profiles, and dimensional requirements of visual display boards. Other visual display boards having equal performance characteristics with deviations from indicated dimensions and profiles may be considered, provided deviations do not change the design concept or intended performance. The burden of proof of equality is on the proposer.

1.5 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

1. Allow for trimming and fitting wherever taking field measurements before fabrication might delay the Work.

1.6 WARRANTY

A. Porcelain Enamel Markerboard Warranty: Furnish the manufacturer's written warranty, agreeing to replace porcelain enamel chalkboards and markerboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking, provided the manufacturer's instructions with regard to handling, installation, protection, and maintenance have been followed.

1. Warranty Period: Lifetime of the building.

PART 2 - PRODUCTS

2.1 PORCELAIN ENAMEL MARKERBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AARCO Products, Inc.
2. Claridge Products
3. DryErase
4. Marsh Industries
5. New Line Products, Inc.

B. Provide balanced, high-pressure-laminated porcelain enamel markerboards of 3-ply construction consisting of face sheet, core material, and backing with a matte finish, type for dry erase markers and video projection screen.

1. Face Sheet: Provide face sheet of 24-gage enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat the exposed face and exposed edges with a 3-coat process consisting of primer, ground coat, and color cover coat, and the concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at the manufacturer's standard firing temperatures, but not less than 1200 deg F.
2. Core: Provide 1/2-inch-thick core material complying with the requirements of ANSI A208.1, Grade L-M-3.
3. Backing Sheet: Provide the manufacturer's standard 0.015-inch-thick aluminum sheet backing.
4. Laminating Adhesive: Provide the manufacturer's standard moisture-resistant thermoplastic-type adhesive.
5. Low gloss finish and designed for projection surface as well as markerboard.

2.2 TACKBOARDS

A. Vinyl-Fabric-Faced Tackboards: Provide mildew-resistant, washable, vinyl fabric complying with FS CCC-W-408, Type II, weighing not less than 13 ounces per square yard, laminated to 1/8-inch-thick cork sheet. Provide fabric that has a flame spread rating of 25 or less when tested in accordance with ASTM E 84. Provide color and texture as scheduled or as selected from the manufacturer's standards.

1. Backing: Make panels rigid by factory laminating 1/8 inch thick cork face sheet under pressure to 3/8-inch-thick fiberboard backing.

2.3 BULLETIN BOARDS

A. Tackboard Panels:

1. Facing: 1/4-inch- thick, natural cork.
2. Core: Manufacturer's standard.
3. Core: 3/8-inch- thick fiberboard.

B. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish; with surface-burning characteristics indicated.

2.4 ACCESSORIES

A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch-thick aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units wherever possible; keep joints to a minimum. Miter corners to a neat, hairline closure.

1. Where the size of boards or other conditions exist that require support in addition to the normal trim, provide structural supports or modify the trim as indicated or as selected by the Architect from the manufacturer's standard structural support accessories to suit the condition indicated.
2. Marker tray: Furnish manufacturer's standard continuous box-type aluminum tray with slanted front and cast aluminum end closures for each Marker board.
3. Map Rail: Furnish map rail at the top of each unit, complete with the following accessories:

    a. Classroom Display Rail: Provide continuous cork display rail approximately 1 inch wide, as indicated, integral with the map rail.
    b. End Stops: Provide one end stop at each end of the map rail.
    c. Map Hooks: Provide 2 map hooks for each 4 feet of map rail or fraction thereof.
    d. Flagholder: Provide one flagholder for each room.
    e. Flags: Provide one (1) flag for each flagholder.

        1) Flag shall be made of fine grade polyester and Made in America, size 2-feet x 3-feet.
        2) Provide 48-inch long black wooden dowel for mounting each flag.

B. Tack Strip: Tack strips shall be aluminum framed, 1-1/2-inch high units with cork insert. Cork shall be resilient, self-healing cork sheet over a 3/8-inch fiberboard backing, mildew resistant and washable.

2.5 FABRICATION

A. Porcelain Enamel Markerboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.

B. Assembly: Provide factory-assembled markerboard and tackboard units, except where field-assembled units are required.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with the minimum number of joints, balanced around the center of the board, as acceptable to the Architect.
2. Provide the manufacturer's standard vertical joint system between abutting sections of markerboard.
3. Provide manufacturer's standard mullion trim at joints between markerboard and tackboard.

2.6 FINISHES

A. Class II Clear Anodized Finish: AA-M12C22A31 (Mechanical Finish: as fabricated, nonspecular; Chemical Finish: etched, medium matte; Anodic Coating: Class II Architectural, clear film thicker than 0.4 mil).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Deliver factory-built, markerboard and tackboard units completely assembled in one piece without joints, wherever possible. Where dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to the Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.

B. Install units in locations and at mounting heights indicated and in accordance with the manufacturer's instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation.

C. Coordinate job-site assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

D. Provide all items and accessories as required for a complete installation in every respect.

3.2 ADJUST AND CLEAN

A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

B. Clean units in accordance with the manufacturer's instructions. Break in markerboards only as recommended by the manufacturer.

END OF SECTION 10 11 00

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SECTION 10 14 00
IDENTIFYING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide labor, materials, and equipment necessary for the complete installation of identifying devices as indicated on the Drawings and specified herein.

1. Interior signage.
2. Interior and Exterior building letters.
3. Interior signage includes, but may not be limited to, the following:

a. Capacity signs.
b. Toilet room handicapped signs.
c. Interior room name and number signs.
d. Storage signs.
e. Fire extinguisher and pull station signs.
f. Access signage.
g. Evacuation signage.
h. Roof access signage.
i. Fire riser inside signage.
j. Interior building letters.
k. Exterior building letters.
l. Egress signage.
m. Exterior Wayfinding Parking Signage.

1.3 SUBMITTALS

A. Product data sheets and samples for each item specified.

1. Manufacturer's color charts consisting of actual units or sections of units showing full range of colors available each product.

B. Furnish shop drawings and other submittals as required for Architect's selection in accordance with Division 01 requirements.

1. Indicate the proposed evacuation routes.
2. Include the following for marquee signage:

a. Fabrication and installation details.
b. Indicate locations and type of electrical service connections.
c. Include detail of permanent copy showing both size and color.

C. Samples:

1. Interior room number and name signs.
2. Interior and exterior building letters.
3. Evacuation signage.
4. Samples for initial Selection: Submit 12” x 12” samples of wayfinding aluminum face sheets painted for Architects review of finish and color.

D. Provide a comprehensive list of all room names and numbers for each building space as well as quantities and locations for all other signs specified.

1. Provide message list for each sign, including exact room name, room number, graphic symbol (if any) and Braille location.

E. Structural Calculations: For exterior wayfinding parking signage indicated to comply with design loadings as indicated, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation registered in the state of Florida.

F. Pre-Erection Conference Meeting Notes for marquee signage

1. Shop Drawings and installation templates.
2. Warranty Requirements: One (1) year warranty

1.4 QUALITY ASSURANCE

A. Reference Codes and Specifications: Florida Building Code, Current Edition and FISH requirements.

B. Room Numbers and FISH Requirements: Once room numbers have been established, they shall remain consistent throughout the life of the building.

1. FISH numbers shall be assigned by Owner, which shall be indicated on the Construction Documents. Once established, no other room designation shall be allowed.

C. Building Numbers:

1. Owner shall assign a unique, two-digit number to all permanent buildings located on the parcel. The number shall be numeric only and will range from 01 – 89. Once established, permanent building number designations will remain unchanged throughout the life of the facility.

D. Room Numbers: Refer to Signage Plan.

1. Owner shall assign a unique, 3-digit FISH number to all spaces in a building. The number shall be numeric and range from 100 through 999.

a. A suffix may be added to FISH numbers for small rooms designated as ancillary spaces to a main room. Suffix shall be a letter A through Z (not including letters I, O and X).

2. Room numbers as indicated on the draiwngs.

E. Contractor Qualifications: Employ only experienced Contractors skilled in the successful manufacture and installation of the signage on similar projects for a minimum of five years.

F. Manufacturer Qualifications: Employ only manufacturers with at least five (5) years experience making the specified materials as a current catalog and regular production item.

G. Pre-Erection Conference: Before erection, meet on site with designated Owners representative and verify exact placement of marquee signage.

H. Source Limitations: Unless specifically noted otherwise, provide products of the same manufacturer for each type of unit.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Interior identifying devices, and exterior building letters shall be as manufactured by one of the following:

1. APCO Graphics, Inc.
2. ASI - Modulex,
3. Bayuk Graphic Systems, Inc
4. Best Sign Systems
5. Environmental Graphics, Inc.
6. Multi-Graphics, Inc.
7. Sign Design of Florida, Inc.
8. Vital Signs of Orlando, Inc.

2.2 INTERIOR SIGNAGE

A. Capacity signs for all rooms with a capacity of 49 persons or more.

1. Provide capacity signs 7 ½ inches by 7 ½ inches with all edges eased on 3/8-inch radius corners, reading "MAXIMUM CAPACITY."
2. Material: 1/8-inch thick clear matted acrylic plastic with all edges eased.
3. Graphic Process: Raised letters and Braille, formed as an integral part of the sign face.
4. Letters: Letters and numbers shall have width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10. Letters and numbers shall be raised 1/32-inch, uppercase, sans serif or simple sans serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be 5/8-inch high minimum and 2 inches high maximum.
5. Characters and backgrounds must be eggshell, matte, or other non-glaze surface.
6. Provide at least two signs per room.
7. This sign shall include the room name and fish number for the space.

B. Toilet Room Handicapped Signs:

1. Provide one sign depicting International Men/Women Symbol at each toilet room, equipped with facilities for handicapped. Size shall be 7 ½ inches by 10 ½ inches with 3/8-inch radius corners.
2. Material: 1/8-inch thick matte acrylic plastic with all edges eased.

3. Graphic Process: Raised letters and Braille, formed as an integral part of the sign face.
4. Colors: Letters and background colors as selected by Architect from manufacturer's standard colors.
5. Letters: Letters and numbers shall have width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10. Letters and numbers shall be raised 1/32-inch, uppercase, sans serif or simple sans serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be 5/8-inch high minimum and 2 inches high maximum. Refer to Drawings for sizes indicated. Pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram.
6. Characters and backgrounds must be eggshell, matte, or other nonglazed surface.

C. Interior Room Name and Number Signs

1. Provide 7 ½ inch by 7 ½ inch signs with 3/8-inch radius corners.
2. Layout of room names and numbers shall be as directed by the Architect. CM to provide list of room names and numbers in “generic” form, i.e., Classroom, Office, etc.
3. Material: 1/8-inch thick matte acrylic plastic with all edges eased.
4. Graphic Process: Raised letters and Braille, formed as an integral part of the sign face.
5. Colors: Letters and background colors as selected by Architect from manufacturer's standard colors.
6. Letters: Letters and number shall have width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10. Letters and numbers shall be raised 1/32-inch, uppercase, sans serif or simple sans serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be 5/8-inch high minimum and 2 inches high maximum.
7. Characters and backgrounds must be eggshell, matte or other non-glaze surface.
8. Classroom: Provide a frame and removable nameplate for teacher’s name mounted directly above the classroom signage. Signage to match classroom sign in format, color and width, height to be 4-1/2-inches..

D. Storage Signs

1. Provide 7 ½ inch by 7 ½ inch signs with 3/8-inch radius corners at electrical, mechanical, kiln room, and fire riser rooms to read NO STORAGE ALLOWED.
2. Signs shall be 1/8-inch thick matte acrylic plastic with all edges eased.
3. Colors: Letters and background colors as selected by Architect from manufacturer's standard colors.
4. Graphic Process: Raised letters and Braille, formed as an integral part of the sign face.
5. Letters: Letters and number shall have width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10. Letters and numbers shall be raised 1/32-inch, uppercase, sans serif or simple sans serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be 5/8-inch high minimum and 2 inches high maximum.
6. Characters and backgrounds must be eggshell, matte or other nonglaze surface.

E. Fire Extinguisher and Pull Station Signs

1. Copy to read:

    a. "Fire Alarm Pull Station inside Classroom"
    b. "Fire Extinguisher inside Classroom"
    c. “Fire Extinguisher inside Kitchen”. The fire protection system shall be activated before using the fire extinguisher. 7 ½ inches x 7 ½ inches Red background with White 2 inches high letters.

2. Provide the above signs in corridors near classrooms that have a fire pull station or fire extinguisher inside. Locate signs in corridors next to classroom doors. White lettering on red background, same material, size, and mounting as in Article 2.2 C, interior room name and number signs.
3. Graphic Process: Raised letters and Braille, formed as an integral part of the sign face.
4. Letters: Letters and number shall have width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10. Letters and numbers shall be raised 1/32-inch, uppercase, sans serif or simple sans serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be 5/8-inch high minimum and 2 inches high maximum.

F. Evacuation Signage

1. Provide evacuation signs 8 ½ inches by 11 inches with all edges eased on 3/8-inch radius corners, indicating a graphic diagram of primary and secondary evacuation routes posted inside, adjacent to the primary exit door. Provide at all rooms with occupancy of 6 students or greater.
2. Material: 1/8-inch thick clear matted acrylic plastic with all edges eased.
3. Colors: Black building plan on white background with evacuation route in red.
4. Signage manufacturer shall be responsible for suggested evacuation routes and indicate on signage.

G. Roof Access Signage

1. Provide Roof Access signage to read: “ROOF ACCESS”. Locate as directed by the Architect.

H. Fire Riser Inside Signage

1. Provide Fire Riser Inside signage to read: “FIRE RISER INSIDE”. Locate as directed by the Architect.

I. Egress Signage

1. Signs for means of egress shall comply with 216.4 of the Florida Accessibility Code, Current Edition.
2. Doors at exit passageways, exit discharge, and exit stairways shall be identified by tactile signs complying with 703.1, 703.2, and 703.5 of the Florida Accessibility Current Edition.
3. Advisory 216.4.1 Exit Doors of the Florida Accessibility Code, Current Edition:

    a. An exit passageway is a horizontal exit component that is separated from the interior spaces of the building by fire-resistance-rated construction and that leads to the exit discharge or public way. The exit discharge is that portion of an egress system between the termination of an exit and a public way.

2.3 INTERIOR BUILDING LETTERS

A. 8 inches high, 1 inch deep letters pin mounted with ¾ inch standout on gypsum board wall in location per the Drawings. Baked enamel finish with style and color to be selected by Architect. Provide list of fonts that will be selected by Architect.

2.4 EXTERIOR BUILDING LETTERS

A. Height and depth, as indicated on the drawings, 3/4 inch standout, baked enamel finish; style, color and location to be selected by Architect. Copy (school name) to be determined.

B. Letter Style as selected by Architect

C. Material: Cast aluminum.

D. Installation Method: Pin mounted, ¾ inch from wall. Tamper-proof, non-rusting, non-corroding, non-staining pin mounted, ¾ inch from the wall as recommended by manufacturer; aluminum letters shall be protected from galvanic action with a coat of asphalt varnish or a zinc-molybdate primer.

E. Provide a clear back on building letters.

F. Verify actual copy and layout with Owner and Architect before fabrication.

G. All specialty graphic signage must be submitted and be approved in writing by the Owner.

2.5 EXTERIOR WAYFINDING PARKING SIGNAGE

A. Aluminum Face Sheet: .0125 inches thick.

1. Plate and Sheet: ASTM B 209, Alloy 5005-H32.

B. Internal Support Structure: As indicated on the Drawings. Refer to Section 05 50 00 “Metal Fabrications.”

C. Fasteners for face sheets; Type 304 Stainless Steel Counter sunk Philips head machine screws sized by sign manufacturer. Color shall match face sheets.

D. Sealants: Provide color matched Silicone for sealing joints in face panels.

a. Dow Corning 795.

E. Graphics: As Indicated on the Drawings.

F. Paint Finish:

1. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

a. Color and Gloss: Match Architect's sample.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Mount interior signage with concealed mechanical fasteners recommended by manufacturer.

C. Provide mounting and installation kits for mounting building letters.

D. Mount exterior and interior building letters in conformance with manufacturer's instructions.

E. Install interior signage in accordance with approved shop drawings, Accessibility Requirements Manual from the Florida Department of Community Affairs, and at locations indicated on the Contract Documents.

F. Inspect materials or equipment immediately upon delivery and again before installation. Reject damaged and defective items.

G. Provide attachment and connection devices necessary for securing Work. Secure Work true to line and level. Allow for building expansion.

H. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

I. Recheck measurements and dimensions, before starting each installation.

J. Isolate incompatible material as necessary to prevent deterioration.

K. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

1. Comply with State and Local ADA Codes and Regulations

END OF SECTION 10 14 00

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SECTION 10 14 16
DEDICATION PLAQUE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal plaques.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plaques.

1. Include fabrication and installation details and attachments to other work.
2. Show plaque mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each plaque at least half size.

C. Samples for Initial Selection: For each type of plaque, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of plaque showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Plaques: Half-size Sample.
2. Exposed Accessories: Full-size Sample of each accessory type.
3. Full-size Samples, if approved, will be returned to Contractor for use in the Project.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For plaques to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design," the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

2.2 METAL PLAQUES

A. Etched Plaque: Chemically etched or photochemically engraved metal sheet or plate with texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A.R.K. Ramos.
b. Gemini Incorporated.
c. Metallic Arts.

2. Plaque Material: Bronze.
3. Plaque Thickness: 0.25 inch.
4. Finishes:

a. Integral Metal Finish: Match Architect's sample.

b. Integral Metal Finish: Match Architect's sample.
c. Overcoat: Manufacturer's standard baked-on clear coating.

5. Integral Edge Style: As indicated on Drawings.
6. Applied Frame Material, Style, and Finish: As indicated on Drawings.
7. Mounting: Concealed studs.
8. Text and Typeface: Match Architect's sample.

2.3 MATERIALS

A. Bronze Castings: ASTM B584, lead-free alloy recommended by manufacturer and finisher for finish indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless steel devices unless otherwise indicated.
3. Plaque Mounting Fasteners:

a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque unless otherwise indicated.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.5 FABRICATION

A. General: Provide manufacturer's standard plaques according to requirements indicated.

1. Preassemble plaques in the shop to greatest extent possible. Disassemble plaques only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.

B. Surface-Engraved Graphics: Machine-engrave characters and other graphic devices into indicated plaque surface to produce precisely formed copy, incised to uniform depth.

1. Engraved Metal: Fill engraved graphics to match Architect’s sample.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 LACQUER COATING FOR COPPER-ALLOY FINISHES

A. Lacquer Coating: Clear, organic, waterborne, air-drying, acrylic lacquer called "Incralac"; specially developed for coating copper-alloy products; consisting of a solution of acrylic resin, methyl methacrylate copolymer, leveling agent, and corrosion inhibitor benzotriazole.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that plaque-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL PLAQUES

A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.

1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as plaques are installed.

C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 16

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SECTION 10 14 65
LED MONUMENT DISPLAY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. LED Monument Display.

1.3 COORDINATION

A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Provide product data and shop drawings of base for display units for coordination.
2. Include fabrication and installation details and attachments to other work.
3. Show mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

C. Samples: For each type of exposed component, and exposed finish.

D. Delegated-Design Submittal:

1. Include structural analysis calculations for attachment indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Evaluation Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

C. Sample Warranty: For special warranty.

D. Provide total electrical load requirements and communication cabling requirements.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For display units to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of display units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Failure of electronic components.

2. Warranty Period: Five (5) years for materials and (2) years for installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design structure and anchorage according to structural performance requirements.

B. Structural Performance: Display units and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.

1. Wind Load: As indicated on Drawings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 LED MONUMENT DISPLAY UNIT

A. Basis of Design: Daktronics, Brookings, SD; “Galaxy” LED Display, or subject to compliance with requirements a comparable product by one of the following:

1. Watchfire Signs.
2. Daktronics.

B. Size and configuration as noted or indicated on drawings.

C. LED Characteristics:

1. Pitch: 19mm - 22mm.
2. PC Type: Standard, measured brightness of not less than 6400 nit.
3. LED Lifetime Warranty: 100,000 hrs.
4. Software: On-Board message scheduler, automatic light adjustment, board word checker, controller capability. The software shall have a North American based technical service support team.
5. Controller: On-Board controller, full color with 16 – 32 levels of dimming.
6. Communications: Ethernet, Fiber Optic. Media converter furnished by others.
7. Electrical Power: Coordinate with power available.
8. Main Visual Display Area: Fully interchangeable to accommodate Owner requirements for events, announcements, and graphics.
9. Display unit enclosure shall be of type and size to accommodate LED equipment and related ancillary components and ventilation as necessary.

D. Accessories: Furnish and install operating remote controls inside building.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that support surfaces are within tolerances to accommodate display units.

C. Verify that anchorage devices embedded in permanent construction are correctly sized and located to accommodate display units.

D. Verify that electrical service is correctly sized and located to accommodate display units.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

F. Coordinate electrical requirements with the Manufacturer and cast all conduits into base. Electrical connections shall be made internally. Exposed, surface mounted electrical boxes are prohibited.

3.2 INSTALLATION

A. General: Install display units using installation methods indicated and according to manufacturer's written instructions.

1. Install level, plumb, and at locations and heights indicated, with surfaces free of distortion and other defects in appearance.
2. Before installation, verify that components are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Make final connections to display unit from electrical power source adjacent to installation. Provide Owner with total electrical load requirements and communication cabling requirements.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged display units that do not comply with specified requirements.

B. On completion of installation, clean exposed surfaces of display units according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain display units in clean condition during construction and protect from damage until acceptance by Owner.

3.4 TRAINING

A. Training: Provide training to Owners personnel on use of LED display units upon completion and acceptance of Work.

END OF SECTION 10 14 65

SECTION 10 21 13
PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes toilet partitions/compartments as follows:

1. Type: Solid plastic (HDPE).
2. Compartment Style: Floor supported, overhead braced.

1.3 SUBMITTALS

A. Product Data: For each type and style of toilet compartment specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.

B. Shop Drawings: Provide fabrication and installation drawings, including appurtenances, cutouts, all accessories, location of steel reinforcement or wood blocking in walls to be constructed by others for proper securing of finished Work. Provide color samples for all available color groups.

C. Samples for Initial Selection: Manufacturer's color charts consisting of sections of actual units showing the full range of colors, textures, and patterns available for each type of compartment indicated.

D. Samples for Verification: Of each compartment color and finish required, prepared on 6-inch-square Samples of same thickness and material indicated for Work.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Only authorized factory installers shall be used.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".

C. Preparation/Field Verification:

1. Prior to installation of wall finishes, verify required blocking has been installed in proper locations.
2. Verify installation of finishes and required anchoring devices are complete.
3. Verify that Shop Drawings have been successfully submitted, reviewed and returned.

4. Take dimension with field measurements prior to component fabrication to ensure proper fitting of work
5. Proceed with installation of items only after unsatisfactory conditions have been corrected. Installation of items indicates all conditions are satisfactory.

D. Source Limitations: Provide products of the same manufacturer for each type of unit specified and for units exposed to view in the same areas.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.6 WARRANTY

A. Manufacturers Warranty: Manufacturer shall provide written warranty for minimum of 15 years against breakage, corrosion and delamination on all products furnished under this Guideline.

1. Warranty shall include full replacement of defective materials without charge.

B. Unless otherwise stated, duration of all warranties shall begin on the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TOILET COMPARTMENTS

A. Basis of Design Product and Manufacturer; as indicated on the Interior Finish Schedule; Subject to compliance with requirements, other available manufacturers offering products that may be incorporated into the Work include the following:

1. Accurate Partitions Corp.
2. American Sanitary Partition Corp.
3. Ampco Products, Inc.
4. Columbia Partitions by Partition Systems, Inc. (PSI) of South Carolina.
5. Scranton Products (Santana/Comtec/Capital).

B. Colors and Texture: As indicated on the Interior Finish Schedule.

2.2 MATERIALS

A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.

1. Color and Pattern: Refer to the Finish Schedule.

B. Door, Panel and Pilaster Construction: Solid, High Density polyethylene (HPDE) not less than 1-inch thickness, seamless, eased edges with homogenous color and pattern throughout thickness of material.

1. Dividing Panels: 55-inches high and mount at 14 inches above finished floor.
2. Doors: 55-inches high and mounted at 14 inches above finished floor. Handicapped doors shall have one door pull and one door stop.

C. Pilasters: 82-inches high, mounted in a one-piece plastic shoe with star-head security pins. Pilaster shall be machined to accept door and hinge mechanism.

1. Pilaster Shoes: Polymer color and pattern matching pilaster.

D. Brackets (Fittings):

1. Continuous Brackets: Full height extruded 6463-T5 brite-dip finished aluminum. All holes pre-drilled, spaced at 12” o.c. for through-bolting with stainless steel theft-resistant type heads. Each bracket shall have a minimum wall thickness of 0.125”.
2. Heat-Sink Strip: Manufacturer’s standard continuous, extruded-aluminum strip fastened to exposed bottom edges of solid-polymer components to prevent burning.

E. Accessories:

1. Hardware and Accessories: All fasteners shall be stainless steel with theft proof heads, through-bolted unless noted otherwise. Chrome plated steel or brass are not acceptable.
2. Overhead Bracing: Continuous heavy duty extruded 6463-T5 brite-dip finish aluminum head rail with anti-grip profile. Provide headrail corner brackets, wall brackets and headrail end caps as required.

    a. Provide floor to ceiling pilaster at accessible compartments at connection to other compartments for termination of overhead bracing.
    b. No headrail at closed alcove accessible compartments.

F. Door Hardware:

1. Hinges: Manufacturer's continuous, self-closing, allowing emergency access by lifting door.
2. Strike and Keeper: Heavy duty cast stainless steel, satin finish. Strike and keeper shall be: 2.50” high; mounting holes at 1.50” o.c.; wall thickness 0.125” inches minimum; have integral rubber bumper door stop.
3. Slide Latch: Heavy duty cast stainless steel, satin finish. Slide latch shall be: 0.150” thick; 1.020” wide; 3.720” long; have internal stainless steel buffering spring; latch knob riveted and welded to slide bar.
4. Coat Hook: Heavy duty cast stainless steel, satin finish. Coat hook and bumper shall be 2.340” high; 1.230” wide; protrude from door 3.05”. Furnish one (1) coat hook per door.
5. Door Bumper: Heavy duty cast stainless steel, satin finish. Door bumper shall have: 2.125” base diameter; protrude 1.80” from wall; 0.250” thick at end of door bumper; 0.6875” shaft diameter.
6. Door Pull: Heavy duty cast stainless steel, satin finish. Door pull handle shall be: 4.735” long; 0.655” wide; protrude 0.940” from face of door; mounted back-to-back with slide latch.

2.3 FABRICATION

A. General: Provide standard doors, panels, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.

1. Compartments shall be provided with emergency access.
2. All connections shall be thru-bolted; inserts shall not be allowed.
3. Panel units shall be provided with eased edges.
4. Attached toilet accessories shall be mounted at the heights indicated.

B. Solid-Plastic, Polymer-Resin Compartments: Provide aluminum heat-sink strips at exposed bottom edges of HDPE units to prevent burning.

C. Doors: Unless otherwise indicated, provide 24-inch- wide in-swinging doors for standard toilet compartments and 36-inch- wide out-swinging doors with a minimum 32-inch- wide clear opening for compartments indicated to be handicapped accessible.

1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.

PART 3 - EXECUTION

3.1 INSTALLATION ENVIRONMENTAL CONDITIONS

A. Items specified shall not be delivered or installed until building is enclosed, wet work completed and HVAC system is operating and maintaining temperature and humidity at occupancy level during remainder of construction period.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Secure units in position with manufacturer's recommended anchoring devices.

1. Provide all items and accessories as required for a total and complete installation in every respect.
2. Install units level, plumb and true, firmly anchored in locations and heights indicated.
3. Adjust and lubricate hardware according to manufacturer’s written instructions.

B. Pilasters: Arrange to prevent overhead cross brace traversing HC stall.

3.3 FIELD QUALITY CONTROL

A. All parts shall be erected straight, level and plumb.

B. No evidence of drilling, cutting or patching shall be visible in the finished work.

C. Vertical edge clearance shall be uniform top to bottom and shall not exceed ¼ inch.

D. Finished surfaces shall be cleaned after installation and left free of imperfections.

E. Adjust and clean hardware for proper operation. Set hinges on in-swing doors to hold open approximately 30 degrees from closed position when unlatched.

F. Provide final protection and maintain conditions that ensure toilet compartments are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10 21 13

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SECTION 10 21 23
CUBICLE CURTAINS AND TRACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cubicle track.
2. Cubicle curtain.

1.3 SUBMITTALS

A. Product Data: Include data on curtain tracks and accessories.

B. Shop Drawings: Show layout of curtain track, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.

C. Curtain Track Schedule: Use same designations indicated on Drawings.

D. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension assembly members.
2. Method of attaching track hangers to building structure.
3. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.

E. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.

F. Operation and Maintenance Data: For curtain track, and hardware to include in operation and maintenance manuals.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not install cubicles until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.5 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Curtain Carriers and Track End Caps: Full-size units equal to 3 percent of amount installed for each size indicated, but no fewer than 10 units.

PART 2 - PRODUCTS

2.1 CURTAIN SUPPORT TRACK

A. Basis of Design Product and Manufacturer; C/S Cubicle Curtains., Model C/S 6062; other manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Imperial Fastener Company, Inc
2. InPro Corporation.

B. Extruded-Aluminum Track: 6063-T5; not less than 1-3/8 inches wide by 3/4 inch high, .060 wall thickness.

C. Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.

1. End Stop: Removable.

D. Curtain Carriers: Manufacturer's standard carriers.

E. Exposed Fasteners: Stainless steel.

F. Concealed Fasteners: Stainless steel.

2.2 CUBICLE CURTAINS

A. Basis of Design Product and Manufacturer; C/S Cubicle Curtains, 100% polyester curtains, opaque fabric, washable, flame retardant and closely woven, other manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. InPro Corporation.
2. Sure-Check Linen

B. Cubicle Curtain Fabric: Fabric shall be inherently and permanently flame resistant, stain resistant, and antimicrobial.

C. Fabrication: Fabricate curtains to comply with the following requirements:

1. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches added fullness.

2. Length: Equal to floor-to-ceiling height, with 20-inch mesh top, and minus distance above the finished floor at bottom as follows:
3. Top Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched.
4. Mesh Top: Top hem not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched. Double lock stitch bottom of mesh directly to 1/2-inch triple thickness, top hem of curtain fabric.
5. Bottom Hem: Not less than 1 inch and not more than 1-1/2 inches wide, double thickness and double lock stitched.
6. Side Hems: Not less than 1/2 inch and not more than 1-1/4 inches wide, with double turned edges, and single lock stitched.

D. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install tracks level and plumb, according to manufacturer's written instructions.

1. Track Mounting: As indicated.

B. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.

C. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.

D. Curtains: Hang curtains on each curtain track.

3.3 PROTECTION

A. Protect installed recessed track openings with nonresidue adhesive tape to prevent construction debris from impeding carrier operation. Remove tape prior to Substantial Completion.

END OF SECTION 10 21 23

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SECTION 10 26 00
WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Corner guards.
2. Wall Protection at Mop Sinks.
3. Decorative Abuse Resistant Wall coverings.
4. Bed locators.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each type of wall protection showing locations and extent.

C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.

D. Samples for Verification: For each type of exposed finish on the following products, prepared on

1. Corner Guards: 12 inches long. Include example top caps.
2. Decorative Abuse-resistant wall coverings: 24-inch x 24-inch panel.
3. Bed Locators: 12 inches long. Include example of end caps.

E. Material Certificates: For each type of exposed plastic material.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store wall protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

a. Store bed-locator covers in a horizontal position.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities.

2.3 CORNER GUARDS

A. Surface-Mounted, Plastic-Cover Corner Guards: Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.

1. Basis-of-Design Product: As indicated on the Finish Schedule, or a comparable product by one of the following:
   a. Construction Specialties
   b. InPro Corporation
   c. Korogard Wall Protection Systems; a division of RJF International Corporation.
   d. Pawling Corporation.

2. Cover: Extruded rigid plastic, minimum .080-inch wall thickness; in dimensions and profiles indicated on Drawings.
   a. Profile: Nominal 3-inch-long leg and 1/4-inch corner radius.
   b. Height: 8feet above wall base.
   c. Color and Texture: As selected by Architect from Manufacturers full range.

3. Continuous Retainer: Minimum 0.060-inch-thick, one-piece, extruded aluminum.
4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

B. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.

1. Provide products by one of the following:

   a. Construction Specialties, Inc.
   b. InPro Corporation
   c. Korogard Wall Protection Systems; a division of RJF International Corporation.
   d. Pawling Corporation.

2. Material: Stainless-steel sheet, Type 304.

   a. Thickness: Minimum 0.0625 inch.
   b. Finish: Directional satin, No. 4.

3. Wing Size: Nominal 1-1/2 by 1-1/2 inches.
4. Corner Radius: 1/8 inch.
5. Mounting: Oval head, countersunk screws through factory-drilled mounting holes.

2.4 MOP SINK WALL PROTECTION

A. Stainless Steel backsplash with hemmed edges installed on walls above mop sink.

1. Thickness: as indicated.
2. Height: as indicated.

B. Seal all edges with clear Sanitary Sealant See Section 07 92 00 “Joint Sealants.”

C. Adhesive: As recommended by panel manufacturer.

2.5 DECORATIVE ABUSE-RESISTANT WALL COVERINGS

A. Basis-of-Design Product and Manufacturer; CS Construction Specialties, Acrovyn, or Subject toc compliance with requirements a comparable product by:

1. Inpro Corporation.

B. Size: 48 inches high x length as indicated.

C. Laminate Thickness: 0.040 inches thick.

D. Color and Texture: Brushed Silver #410.

E. Height: As indicated.

F. Trim and Joint Moldings: (Seams Shall be Welded)

1. Finish: Match Architect's sample.
2. Configuration: As indicated.

G. Mounting: Adhesive.

2.6 BED LOCATORS

A. Bed Locators: Manufacturer's standard assembly consisting of continuous snap-on plastic cover installed over continuous retainer; with two bed-locator end caps and mounting hardware; cover designed to spring back when hit.

1. Basis-of-Design Product: Subject to compliance with requirements, provide HIS, Hospital Systems Inc.; Bed Locator and Docking Station, Part No. 218612 or a comparable product by one of the following:

a. Koroseal Interior Products, LLC.
b. Nystrom, Inc.
c. inpro Corporation.

2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness.

a. Color and Texture: As selected by Architect from manufacturer's full range.

3. Mounting Type: Surface mounted.

2.7 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required; thickness as indicated.

B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D 256, Test Method A.

C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.8 FABRICATION

A. Fabricate wall protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.9 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the Work.

B. Examine walls to which wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall protection in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Adjust caps as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 10 26 00

SECTION 10 28 13
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Samples: Full size, for each exposed product and for each finish specified.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals, including replaceable parts and service recommendations.

1.7 QUALITY ASSURANCE

A. Inserts and Anchorages: Furnish accessory Manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other Work to avoid delay.

B. Single-Source Responsibility: Provide products of same Manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.

1.8 PROJECT CONDITIONS

A. Coordination: Coordinate accessory locations, installation, and sequencing with other Work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

1.9 WARRANTY

A. Toilet Accessory Warranty: Provide manufacturers one (1) year warranty from the Date of Substantial Completion, against defects in material and workmanship.

B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.

1. Minimum Warranty Period: 15 years, minimum; multi-year warranties standard for the product provided by the manufacturer for all toilet accessories.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

1. Basis-of-Design Product: Subject to compliance with requirements, units indicated on the Toilet Accessory Schedule.

2.3 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

F. Tempered Glass Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. No names or labels are permitted on exposed faces of toilet and bath accessory units. On either interior surface not exposed to view or on back surface, provide identification of each accessory item either by a printed, waterproof label or a stamped nameplate indicating Manufacturer's name and product model number.

C. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

D. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.

E. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:

1. Provide galvanized-steel backing sheet, not less than 0.034 inch (22 gage) and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.
2. Mirror glass shall be tempered.

F. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theftproof installation, as follows:

1. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
2. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

G. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

F. Recheck measurements and dimensions, before starting each installation.

G. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

3.2 INSTALLATION

A. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to Manufacturer's instructions for type of substrate involved.

C. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F 446.

D. Provide all items and accessories as required for a complete and total installation in every respect, whether or not specified or indicate don the Drawings.

3.3 ADJUSTING AND CLEANING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 10 28 13

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SECTION 10 41 16
EMERGENCY KEY CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Emergency Key Cabinets.

1.3 SUBMITTALS

A. Product Data: For each type of product. Include material descriptions, dimensions and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each exposed finish.

D. Statement of Compliance: The installer shall certify that the specified products or assemblies have been installed in accordance with manufacturer's requirements, and are approved by the Owner and Authority Having Jurisdiction.

1.4 QUALITY ASSURANCE

A. Contractor Qualifications: Employ experienced Contractors (Installers) skilled in the successful installation of the specified or similar products for a minimum of five years. Installers shall be state-certified or licensed Sub-Contractors, or locally registered Sub-Contractors.

B. Manufacturer(s) Qualifications: Employ only manufacturers making the specified materials as a current catalog and regular production item.

C. Verify that product submittals have been successfully submitted, reviewed and returned.

1.5 WARRANTY

A. Provide Manufacturer's standard Warranty.

1. Warranty Requirements: One (1) year warranty, from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, PRODUCTS, EQUIPMENT, MANUFACTURED UNITS

A. Basis of Design Product and Manufacturer; KNOX, Model Electronic Knoxvault 4400.

1. System Description:

a. Dimensions: Approximately 7” wide X 7” high X 5” deep.
b. Wall Thickness: Manufacturers standard.
c. Construction: Cold-Formed Hollow Structural Steel sections conforming to ASTM A 500 grade A.
d. Finish: Manufacturers standard.

1) Color: Gloss Black.

e. Mounting: Recessed.
f. Rating: UL listed as a Fire Control Accessory.
g. Keying: The emergency key cabinet shall be equipped with a removable cover that has two (2) different cylinders to open the removable cover.

1) Keying: It shall be the responsibility of the Manufacturer to do the Master Keying for access keys. Coordinate keying with Owners requirements.

h. Facility Key: Opening the emergency key cabinet will allow access to a Facility Master Key or Keys. The Master Key shall be on a chain or a hook.
i. Hardware: Each emergency key cabinet shall be supplied with four (4) tamper proof (security) bolts, nuts and washers that allow installation of the cabinet into the wall. A bolt pattern template shall also be supplied with the cabinet.

B. System Mounting:

1. Emergency key cabinet (lock box) shall be installed by the Contractor.
2. Location: As Indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Any corrections in emergency key cabinet installation shall be the responsibility of the emergency key cabinet installer.

END OF SECTION 10 41 16

SECTION 10 43 13
DEFIBRILLATOR SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Defibrillator cabinets.
2. Defibrillators
3. Defibrillator accessories

1.3 SUBMITTALS

A. Product data for cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.

B. Samples for initial selection purposes in the form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of cabinet finish indicated or exposed to view.

C. Shop Drawings:

1. Small-scale plans showing locations of defibrillator cabinets.
2. Schedules showing each type of cabinet to ensure proper fit and function.
3. Indicate installation procedures and accessories required for a complete installation.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain defibrillators and cabinets from one source from a single Manufacturer.

B. Coordination: Verify that cabinets are sized to accommodate type and capacity of defibrillators indicated and provided by Owner under separate Contract.

C. Contractor’s Qualifications: Firm that is skilled in the successful installation of the specified materials and assemblies in previous, similar projects and with not less than 5 years experience.

D. Manufacturer’s Qualifications: Firm with not less than 5 years experience making the specified units as current, production item.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and protect defibrillator cabinets and related materials using means and methods that will prevent damage, deterioration, or loss.

1. Deliver components in manufacturer's original packaging, properly labeled for identification.

1.6 WARRANTY

A. Manufacturers Standard (7) seven year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide cabinets and accessories produced by a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Samaritan AED Package

D. Includes:
- **Samaritan® PAD**
- 1 Pair of Electrode Pads & Batteries
- 1 Soft Carry Case
- 1 User Manual
- 1 Quick Reference Instruction Card
- 7 Year AED Warranty
- AED Medical Prescription
- AED 3D Wall Sign
- AED Inspection Tag

- AED Wall Cabinet with alarm and strobe
- AED/ CPR Responder Kit
- AED Decal Sticker

E. Provide all items and accessories as required for a complete installation in every respect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets will be installed, and blocking where surface mounted cabinets will be installed.

1. Notify the Contractor in writing of conditions detrimental to proper and timely completion of the installation.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cabinets in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities. Including but not limited to the following:

B. Prepare recesses in walls for defibrillator cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.

C. Securely fasten cabinets to structure, square and plumb, to comply with manufacturer=s instructions.

D. Maintain fire ratings where cabinets are recessed into fire-rated wall systems.

E. Cabinet Lettering:

1. Location: Face of glass surface.

3.3 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as defibrillator cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by cabinet manufacturer.

E. Replace cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 43 13

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-protection cabinets.
2. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.3 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire-protection cabinets and fire extinguishers, including, but not limited to, the following:

a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing semirecessed method and relationships of box and trim to surrounding construction.
2. Show location of knockouts for hose valves.

C. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

D. Samples for Initial Selection: For each type of exposed finish required.

E. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches square.

F. Product Schedule: For fire-protection cabinets. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.7 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.4 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Activar Construction Products Group, Inc. - JL Industries.
b. Larsens Manufacturing Company.
c. Nystrom.

B. Cabinet Construction: Rated to match wall rating if applicable.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Aluminum sheet.

1. Shelf: Same metal and finish as cabinet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

E. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.

F. Cabinet Trim Material: Extruded-aluminum shapes.

G. Door Material: Aluminum sheet.

H. Door Style: Vertical duo panel with frame.

I. Door Glazing: Clear float glass.

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting door pull and friction latch.
2. Provide manufacturer's standard hinge, permitting door to open 180 degrees.

K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

L. Materials:

1. Aluminum: ASTM B221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.

    a. Finish: Clear anodic.

2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.5 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

a. Activar Construction Products Group, Inc. - JL Industries.
b. Larsens Manufacturing Company.
c. Nystrom.

2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
3. Valves: Manufacturer's standard.
4. Handles and Levers: Manufacturer's standard.
5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Aluminum Container: UL-rated 3-A:40-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-aluminum container.

C. Purple-K Dry-Chemical Type in Aluminum Container: UL-rated 30-B:C, 5-lb nominal capacity, with potassium bicarbonate-based dry chemical in enameled-aluminum container.

2.8 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets.
2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Identification:

1. Apply vinyl lettering at locations indicated.

D. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.

E. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 00

SECTION 10 51 00
STANDARD LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:

1. Employee Lockers
2. Student Lockers

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

1. Include type of material, gauges of metal, reinforcement, closures and fillers, finishing strips, sloping tops, end finish panels and other details of construction. Identify methods and details of attachment, layout of the lockers, and devices to be furnished by others.
2. Include locker-numbering sequence.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

D. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals specified in Division 1.

E. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: When used with an entity, "experienced" means having successfully completed a minimum of 5 projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Pre-installation Conference:

1. Conduct conference at Project site.
2. Installer shall review sequences of locker type delivery and installation and be familiar with all locker features and accessories.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver lockers until spaces to receive them are clean, dry, and ready for locker installation.

B. Protect lockers from damage during delivery, handling, storage, and installation.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Lockers: 2-years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance: Lockers must withstand constant use, and physical abuse (strong frame, higher gauge material thickness and door construction); provide problem-free, quiet operation (sound insulation and rubber sound control); be durable over the life of the unit (welded frames, strong finish and wearing parts); resist tampering, break-ins, theft, vandalism and unauthorized use (locking, latching and door strength); protect the contents from scratches, cracking and dents (interior finish); be easily repairable and maintainable sloping hoods.

2.2 MANUFACTURERS

A. Acceptable Manufacturers: Provide lockers by one of the following:

1. Art Metal Products
2. ASI Storage Solutions, Inc.
3. DeBourgh All American Lockers
4. Hallowell
5. List Industries, Inc.
6. Lyon Metal Products
7. Penco Products, Inc.

8. Republic Storage Systems Company

2.3 LOCKER TYPES

A. Lockers shall have a "quiet" lock bar assembly. Moving parts within door shall be cushioned by rubber or other means to achieve maximum sound suppression.

2.4 LOCKERS

A. Student and Employee Lockers:

1. Material/Type: Steel; knock down (KD) construction/double-tiered.
2. Size and Configuration: As Indicated.
3. Body: Assembled by with standard fasteners, with not exposed fasteners on door faces or face frames. Assembly of components preferred off site.
4. Frames: Channel formed, minimum 0.0528 in. thick welded frames. Provide minimum 0.0528 in. thick horizontal frame between doors of double-tiered lockers.
5. Doors: One piece, minimum 0.0677 in. thick with louvered vents.
6. Door Stiffener: Minimum 0.0428 in. thick, full-height, 3” width, MIG welded top and bottom flange.
7. Door Strike: Continuous vertical door strike at both hinge and latch side.
8. Door Hinges: Minimum 0.0528 in. thick continuous piano hinge or 3-1/2” long, 0.0897 in. seven knuckle pin type, securely riveted to frame and welded to door.
9. Body Components: Minimum 0.0209 in. thick.
10. Shelves and Bottoms: Minimum 0.0329 in. thick.
11. Door Handle: Deep-drain stainless steel recessed handle.
12. Latching System: Single-point non-moving latch hook.
13. Latch: Minimum 0.1116 in. thick MIG welded latch with pry resistant lug with a horizontal support channel.
14. Hooks: 2-single-prong wall hooks and 1-double-prong ceiling hook.
15. End Finishing Panels: ½” thick High Density Polyethylene (HDPE), containing a minimum of 10% recycled material which is waterproof, impact resistant, containing a self lubricating Poly-Glaze “280” surface that resists marking with pens, pencils, lipstick, and other writing or marking utensils.
16. Continuous Z-Base: 6” high, manufacturer’s standard thickness. Continuous base not required when lockers are installed on a raised base.
17. Continuous Sloping Tops: Minimum 0.0528 in., manufacturer’s standard with splice covers and end closures.
18. Number Plates: Aluminum numbering plates with 3/8-inch high embossed or etched numbers, attached near top of door. Numbering selected by Architect.
19. Finish: Baked enamel, interior and exterior.

    a. Colors:

        1) Exterior Colors: Refer to the Finish Materials List.
        2) Interior Color: Interior components to be of a standard color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install metal lockers and accessories level, plumb, rigid, and flush according to manufacturer's written instructions.

B. Knock down lockers shall be assembled off-site at locker manufacturer’s facility.

C. Anchor lockers to floors and walls at intervals recommended by manufacturer, but not more than 36 inches on center. Install anchors through backup reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.

D. Attach sloping top units to lockers, with closures at exposed ends.

E. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed lockers.

3.2 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust doors and latches to operate easily without binding. Check every locker and verify that integral locking devices operate properly and that all accessories have been installed.

B. Clean interior and exposed exterior surfaces and polish nonferrous-metal surfaces.

C. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit locker use during construction.

D. Touch up marred finishes, or replace locker units that cannot be restored to factory-finished appearance. Use only materials and procedures furnished by locker manufacturer.

E. Provide final protection and maintain conditions that ensure that metal lockers are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10 51 00

SECTION 10 51 13
P.E. LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:

1. Lockers.
2. Benches.

1.3 SUBMITTALS

A. Shop Drawings: Submit shop drawings before fabrication.

1. Shop drawings shall indicate type of material, gauges of metal, reinforcement, filler, finishing strips, and other details of construction. They shall show methods and details of attachment, layout of the lockers, and devices to be furnished by others.
2. When a numbering system is indicated, shop drawings shall identify the locations where each series is to be installed.

B. Submit for Architect's selection samples of manufacturer's full color line, including standard and optional colors (minimum of 15 colors).

C. Colors: As selected by Architect.

1.4 WARRANTY

A. Manufacturer’s Warranty: Provide manufacturer’s written warranty that lockers are and will be free of all defects in materials and workmanships for the indicated warranty period.

1. Warranty Period: Lifetime of installation from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Acceptable Manufacturers: Provide lockers and benches by one of the following:

1. Art Metal Products

2. ASI Storage Solutions, Inc.
3. DeBourgh All American Lockers
4. Hallowell
5. List Industries, Inc.
6. Lyon Metal Products
7. Penco Products, Inc.
8. Republic Storage Systems Company

2.2 MATERIALS AND CONSTRUCTION

A. Types: Lockers shall be pre-assembled of welded construction in multiple column units to meet job conditions. Lockers to be installed in the field by bolting units together.

1. Size: As indicated.
2. Configuration: As indicated.

B. Materials: Sheet steel used in fabrication shall be galvanized, prime grade, free from scale and imperfections. Locking mechanisms and hooks must be zinc plated. Installation hardware to be zinc plated. Locker construction shall of the fully welded type.

C. Wardrobe Doors: 14 gauge wardrobe doors shall be diamond perforated, have one inch double bends on both sides, and single 7/8 inch bend at top and bottom. Hinges shall be five knuckle tight pin type and shall be recessed in doors. Two hinges on doors under 48 inches and 3 on doors 48 inches and longer. Rubber bumpers shall be riveted to stops.

1. Provide ten (10) additional doors of each locker color selected for Owner's attic stock.

D. Locking device shall be completely recessed in door and be fingertip lift control and shall include a built-in combination lock with master key.

E. Vertical Dividers: Shall be 18 gauge with 16 gauge solid end panels at ends of rows.

F. Sloped Tops: Shall be formed from 16 gauge cold rolled sheet steel. Flat tops to receive solid plastic cover as indicated on drawings.

G. Shelves for Athletic Lockers: Shall be perforated 16 gauge and have double ¾ inch bends at front.

H. Backs: Shall be 18 gauge cold rolled sheet steel. Provide 13 gauge flattened expanded metal backs for back to back units.

I. Hooks: For openings 18 inches or more in height shall be electrogalvanized, hardened steel 5/32 inch by 3/8 inch with rounded edges securely riveted in place. Quantity will depend on size of locker.

J. Number Plates: Each locker opening shall have an aluminum number plate with 3/8 inch high numerals, riveted to door at time of installation. Numbering system will be provided at a later date.

K. Finish: Units shall be thoroughly cleaned, given a bonding and rust inhibitive treatment, electrostatically sprayed with a heavy coat of high quality enamel on epoxy, then baked at 300-325 degrees F.

L. Provide fillers, trim, and necessary accessories.

M. Provide solid end panels with minimum penetrations at exposed ends of locker rows and standard solid end panels at unexposed locker ends and inside corners.

N. Opening mechanism for handicapped lockers shall be in strict accordance with ADA Accessibility requirements.

O. End and Top Finishing Panels: Solid Plastic: Solid Plastic Materials: High Density Polyethylene (HDPE) containing a minimum of 10% recycled material which is waterproof, corrosion proof, impact resistant nonabsorbent, and has a self lubricating Poly-Glaze "280" surface that resists marking with pens, pencils, lipstick, and other writing or marking utensils.

1. Colors selected by the Architect from manufacturer’s standard colors.

P. Locker Room Benches: Solid plastic locker benches shall be fabricated from High Density Polyethylene (HDPE) consisting of virgin resin materials in colors that extend throughout the surface which is waterproof, non-absorbent and has a self-lubricating surface that resists marking with pens, pencils or other writing utensils. The solid plastic locker benches shall have recycled and/or virgin materials (HDPE) as the core material. All solid plastic locker benches shall arrive at job-site with special protective covering.

1. Finish of locker benches shall be similar and equal to Santana Products Inc. "Plasti-Glaze 280."
2. Colors shall be selected from the manufacturer's full range of colors.
3. Locker Bench:

    a. Solid plastic locker bench tops shall be 9-1/2" wide; maximum length is 96" long.
    b. Solid plastic locker benches shall be a minimum of 1-3/8" thick and all edges machined to a radius of .250" and all exposed surfaces to be free of saw marks.

4. Pedestal Legs:

    a. Pedestal legs to be square, size as indicated on the drawings, cored and grouted into concrete slab.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Installer for the Work under this Section shall install the equipment required in strict accordance with the manufacturer's specifications, instructions, and recommendations.

1. This shall include the proper assembly of lockers and their installation in accurate position and alignment. Screws and other assembly devices shall be properly installed and tightly drawn.
2. Install end panels and filler plates to complete each section of the assembly.
3. Install finishing strips required to bring the completed assembly into proper finished condition, as called for on the Drawings.

B. Lockers shall be securely attached to the wall, to the base, and to each other. Lockers shall be leveled with cedar shims, where necessary, to provide for irregularities in the base.

C. Lockers shall be protected against scratches and damage during remainder of construction period and until Date of Substantial Completion.

END OF SECTION 10 51 13

SECTION 10 51 23
ATHLETIC LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:

1. Lockers.
2. Benches.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

1. Include type of material, gauges of metal, reinforcement, closures and fillers, finishing strips, sloping tops, end finish panels and other details of construction. Identify methods and details of attachment, layout of the lockers, and devices to be furnished by others.
2. Include locker-numbering sequence.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

D. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals specified in Division 1.

E. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: When used with an entity, "experienced" means having successfully completed a minimum of 5 projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Pre-installation Conference:

1. Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".
2. Installer shall review sequences of locker type delivery and installation and be familiar with all locker features and accessories.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver lockers until spaces to receive them are clean, dry, and ready for locker installation.

B. Protect lockers from damage during delivery, handling, storage, and installation.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures.
   b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for All-Welded Metal Lockers: Lifetime from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Provide lockers by one of the following:

1. Art Metal Products
2. ASI Storage Solutions, Inc.
3. DeBourgh All American Lockers
4. Hallowell
5. List Industries, Inc.
6. Lyon Metal Products
7. Penco Products, Inc.
8. Republic Storage Systems Company

2.2 LOCKERS

A. Athletic Lockers:

1. Material/Type: Steel; all-welded construction.
2. Size: As indicated.
3. Configuration: As indicated.

4. Body: Assembly by use of fully framed all-welded components together.
5. Frames: Channel formed minimum 0.0528 in. thick galvanneal metal welded frames. Provide minimum 0.0528 in. thick galvanneal metal horizontal frame.
6. Sides: Minimum 0.0528 in. thick galvanneal metal, diamond perforated.
7. Backs: Minimum 0.0428 in. thick galvanneal metal.
8. Solid Top, Bottom and Intermediates Shelves: Minimum 0.0428 in. thick galvanneal metal.
9. Doors: Minimum 0.0677 in. thick galvanneal metal, diamond perforated.
10. Door Stiffener: Minimum 0.0428 in. thick, full-height, 3” width, MIG welded top and bottom flange.
11. Door Handle: Deep-drain stainless steel recessed handle.
12. Latching System: Single-point non-moving latch hook.
13. Latch: Minimum 0.1116 in. thick MIG welded latch with pry resistant lug with a horizontal support channel.
14. Hooks: 2-single prong wall hooks and 1-double prong ceiling hook.
15. End and Top Finishing Panels: ½” thick High Density Polyethylene (HDPE), containing a minimum of 10% recycled material which is waterproof, impact resistant, containing a self-lubricating Poly-Glaze “280” surface that resists marking with pens, pencils, lipstick, and other writing or marking utensils.
16. Raised Base: Coordinate with architectural requirements for methods of locker base attachment to substrate.
17. Continuous Sloping Tops: Minimum 0.0528 in. thick galvanneal steel, manufacturer’s standard with splice covers and end closures.
18. Identification - Number Plates: Manufacturer’s standard aluminum numbering plates with 3/8-inch high embossed or etched numbers, attached near top of door, centered, with a least two aluminum rivets. Numbering selected by Architect.
19. Finish: Galvanneal sheet steel with baked enamel, interior and exterior. Colors – two-tone color combination at no additional cost, chosen from manufacturer’s standard selection.

B. Locker Room Benches: Solid plastic locker benches shall be fabricated from High Density Polyethylene (HDPE) consisting of virgin resin materials in colors that extend throughout the surface which is waterproof, non-absorbent and has a self-lubricating surface that resists marking with pens, pencils or other writing utensils. The solid plastic locker benches shall have recycled and/or virgin materials (HDPE) as the core material. All solid plastic locker benches shall arrive at job-site with special protective covering.

1. Finish of locker benches shall be similar and equal to Santana Products Inc. "Plasti-Glaze 280."
2. Colors shall be selected from the manufacturer's full range of colors.
3. Locker Bench:

    a. Solid plastic locker bench tops shall be 9-1/2" wide; maximum length is 96" long.
    b. Solid plastic locker benches shall be a minimum of 1-3/8" thick and all edges machined to a radius of .250" and all exposed surfaces to be free of saw marks.

4. Pedestal Legs:

    a. Pedestal legs to be square, size as indicated on the drawings, cored and grouted into concrete slab.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install metal lockers and accessories level, plumb, rigid, and flush according to manufacturer's written instructions.

B. Knock down lockers shall be assembled off-site at locker manufacturer’s facility.

C. Anchor lockers to floors and walls at intervals recommended by manufacturer, but not more than 36 inches on center. Install anchors through backup reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.

D. Attach sloping top units to lockers, with closures at exposed ends.

E. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed lockers.

3.2 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust doors and latches to operate easily without binding. Check every locker and verify that integral locking devices operate properly and that all accessories have been installed.

B. Clean interior and exposed exterior surfaces and polish nonferrous-metal surfaces.

C. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit locker use during construction.

D. Touch up marred finishes, or replace locker units that cannot be restored to factory-finished appearance. Use only materials and procedures furnished by locker manufacturer.

E. Provide final protection and maintain conditions that ensure that metal lockers are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10 51 23

SECTION 10 73 16
ALUMINUM CANOPIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Prefabricated aluminum canopies.

1.3 SUBMITTALS

A. Product Data: Submit product data, specifications, component performance data and installation instructions.

B. Shop Drawings: Submit detailed drawings, layout metal canopies, all mechanical joint locations with complete details, connections, jointing and accessories.

C. Calculations: Provide signed and sealed structural calculations produced by a professional structural engineer registered in the state where the project is located.

D. Samples:

1. Samples for Verification: Manufacturer's standard samples for color indicated.

1.4 PERFORMANCE REQUIREMENTS

A. System Performance: Provide metal canopy system that has been designed, produced, fabricated and installed to withstand normal temperature changes as well as live loading, dead loading and wind loading in compliance with Code requirements for geographic area in which work is located and as follows:

1. Live Load: 20-psf minimum.
2. Design Wind Velocity: As indicated on the Drawings.

B. Structure shall be capable of sustaining severe weather including rain, hail, and hurricane force winds, and supporting a concentrated load such as being walked upon.

1.5 QUALITY ASSURANCE

A. Installer Qualification: Firm with not less than three (3) years' experience in installation of aluminum walkway covers of type, quantity and installation methods similar to canopy system indicated.

B. Shop Assembly: Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

B. Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: Minimum 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PREFABRICATED ALUMINUM CANOPIES

A. Product and Manufacturer – Basis of Design: Super Lumideck Flat Soffit; Mapes Architectural Canopies, LLC

1. Provide with perforated aluminum infill panels.
2. Fascia Profile: As indicated.

B. Other Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:

1. Dittmer Architectural Aluminum
2. Perfection Architectural Systems
3. Peachtree Protective Products

C. Interior framing members; Aluminum Type 6063-T5 aluminum.

D. Provide with hanger rod connections; standard hanger rod configuration.

E. Fascia Profile: As indicated.

2.2 MATERIALS

A. Aluminum: All aluminum extrusions shall be alloy 6063 heat treated to a T-6 temper.

B. Fasteners: Manufacturer's standard.

1. Deck Screws (rivets not permitted): Type 18-8 non-magnetic stainless steel sealed with a neoprene "O" ring beneath 5/8" outside dimension, conical washer.
2. Fascia Rivets: Size 3/16" by 1/2" grip range aluminum rivets with aluminum mandrel.
3. Bolts: All bolts, nuts and washers to be 18-8 non-magnetic stainless steel.
4. Tek Screws: Not permitted.

2.3 FABRICATION

A. General: Comply with indicated profiles, dimensioned requirements and structural requirements.

B. Framing: Beams and columns shall consist of shop welded one piece units.

1. Use sections true to details with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture, free from defects impairing strength and durability.
2. All welding shall be in accordance with manufacturer's requirements.
3. Mechanical joints shall consist of stainless steel bolts with a minimum of two (2) bolts per fastening. Bolts and nuts shall be installed in a concealed manner utilizing 1/2" thick by 1 1/2" aluminum bolt bars welded to structural members.

C. Roof Deck: Extruded aluminum shapes, interlocking self-flashing sections. Shop fabricate to lengths and panels widths required for field assembly. Depth of sections shall comply with structural requirements. Welded dams are to be used at non-draining ends of deck.

1. Profile: As indicated.
2. Expansion Joints: Provide expansion joints; design structure for thermal expansion and contraction as required.
3. Exposed Rivets: Rivets used to fasten bottom of fascia to deck shall be finished to match the deck.

2.4 ALUMINUM FINISH

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install metal canopy system in accordance with the manufacturer's instructions.

1. Field confirm dimensions and elevations shown.

2. Install roof deck sections, accessories and related flashing in accordance with manufacturer's instructions. Provide roof slope for rain drainage without ponding water. Align and anchor roof deck units to structural support frames.

3.2 CLEANING AND PROTECTION

A. Damaged Units: Replace roof deck panels and other components of the work that have been damaged or have deteriorated beyond successful minor repair.

B. Cleaning: Remove protective coverings at time in project construction sequence that will afford greatest protection of work. Clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction.

C. Protection: Provide protection and surveillance, as required to ensure that work of this section will be without damage or deterioration at time of substantial completion.

END OF SECTION 10 73 16

SECTION 10 73 26
WALKWAY COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Pre-engineered canopies.

1.3 SUBMITTALS

A. Product Data: Submit product data, specifications, component performance data and installation instructions.

B. Shop Drawings: Submit detailed drawings, layout of canopy, framing locations (identify drain columns, all mechanical joint locations with complete details, connections, jointing and accessories. Include details of concrete footings and frame anchorage.

C. Calculations: Provide signed and sealed structural calculations for the proposed canopy, produced by a professional structural engineer registered in the state of Florida.

D. Samples: Provide the following samples for initial selection of color as required and for verification of compliance with requirements indicated.

1. Samples for Verification: For the following products, in manufacturer's standard sizes, in the profile and style indicated. Prepare Samples from the same material to be used for the Work.

a. Roof Panels: 12 inches long by actual panel width. Include clips, caps, battens, fasteners, closures, and other exposed panel accessories.
b. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
c. Framing: 12 inches long.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following except as otherwise indicated:

1. Standard Building Code, latest addition with amendments, if any.
2. AWS (American Welding Society) standards for structural aluminum welding.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of aluminum canopy systems that are similar to those indicated for this Project in material, design, and extent.

C. Installer Qualifications:

1. An authorized representative of the canopy manufacturer, with a minimum of five years experience, for installation of units required for this project

D. Manufacturer Qualifications:

1. A firm experienced in manufacturing products or systems similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to insure proper fitting of work.

B. Shop Assembly: Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Coordination: Coordinate work of this section with work of other sections which interface with canopy system (sidewalks, curbs, building fascias, etc.).

1.5 PERFORMANCE REQUIREMENTS

A. System Performance: Provide a canopy system that has been successfully tested by a qualified testing and inspecting agency to withstand the effects of the following:

1. Basic Wind Speed: As indicated on the Drawings.
2. Occupancy Factor: As Indicated.
3. Wind Load Importance Factor: As Indicated
4. Exposure Category: As Indicated.
5. Sizes: Sizes indicated are to be considered minimum.

B. Structure shall be capable supporting a concentrated load such as being walked upon.

1.6 WARRANTY

A. Manufacturer’s special warranty to repair or replace components of the system that have failed within a one year period after final payment has been received by the contractor or at the issuance of a certificate of completion.

B. Installer’s special warranty that agrees to repair or replace components of a specified system that fails in workmanship for a period of two years after final payment has been received by the installing contractor.

C. Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: Minimum 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRE-ENGINEERED CANOPY

A. Acceptable Manufacturers:

1. Dittmer Architectural Aluminum.
2. Childers Carports & Structures Inc.
3. Perfection Architectural Systems.
4. Peachtree Protective Products.
5. Mason – Florida, L.L.C.

2.2 MATERIALS

A. Aluminum: All aluminum extrusions shall be alloy 6063 heat treated to a T-6 temper.

B. Aluminum Flashing: Aluminum sheet; manufacturer’s standard thickness for installations indicated; finish to match canopy.

C. Fasteners: All fasteners shall be aluminum, 18-8 stainless steel, or 300 series stainless steel.

D. Protective Coating: Aluminum columns embedded in concrete shall be protected by clear acrylic.

E. Grout: Grout shall be 2000 p.s.i. compressive strength, 1 part Portland cement and 3 parts masonry sand. Add water to produce pouring consistency.

F. Gaskets: Gaskets shall be dry seal santoprene pressure type.

2.3 FABRICATION

A. General: Comply with indicated profiles, dimensioned requirements and structural requirements.

B. Framing: Beams and columns shall consist of shop welded one piece units. When size of framing members does not permit shipment as a welded unit, concealed mechanical joints may be used.

1. Use sections true to details with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture, free from defects impairing strength and durability.
2. All welding shall be in accordance with manufacturer’s requirements.

3. Mechanical joints shall consist of stainless steel bolts with a minimum of two (2) bolts per fastening. Bolts and nuts shall be installed in a concealed manner utilizing 1/2" thick by 1 1/2" aluminum bolt bars welded to structural members.

C. Roof Deck: Extruded aluminum shapes, interlocking self-flashing sections. Shop fabricate to lengths and panels widths required for field assembly. Depth of sections shall comply with structural requirements. Welded dams are to be used at non-draining ends of deck.

1. Profile: 3-inch high by 5-inch wide profile (nominal), extruded.
2. Fascia: 6-inches.
3. Expansion Joints: Provide expansion joints; design structure for thermal expansion and contraction as required.
4. Exposed Rivets: Rivets used to fasten bottom of fascia to deck shall be finished to match the deck.

PART 3 - ALUMINUM FINISH

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 4 - EXECUTION

4.1 INSTALLATION

A. General: Install canopy system in accordance with the manufacturer's instructions.

1. Concrete Footings: Refer to Division 03, Concrete.

B. Erection: Set roof support frames into pockets provided in top of footings; set to required elevations, align, plumb and level; and grout in place with 2,000 p.s.i. Portland cement grout. Assure that grout fills all voids and "keys" to columns. Fill downspout units with grout to bottom of discharge level. Install aluminum deflectors after grouting.

1. Install roof deck sections, accessories and related flashing in accordance with manufacturer's instructions. Provide roof slope for rain drainage without ponding water. Align and anchor roof deck units to structural support frames.

4.2 CLEANING AND PROTECTION

A. Damaged Units: Replace roof deck panels and other components of the work which have been damaged or have deteriorated beyond successful minor repair.

B. Cleaning: Remove protective coverings at time in project construction sequence which will afford greatest protection of work. Clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction.

C. Protection: Provide protection and surveillance, as required to ensure that work of this section will be without damage or deterioration at time of substantial completion.

END OF SECTION 10 73 26

SECTION 10 75 00
FLAGPOLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Aluminum flagpoles.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide flagpoles capable of withstanding the effects of wind loads as determined according to the building code in effect for this Project or NAAMM FP 1001, "Guide Specifications for Design Loads of Metal Flagpoles," whichever is more stringent.

1. Base flagpole design on maximum standard-size flag suitable for use with pole.
2. Wind Speed: Refer to the Structural Drawings.

1.4 SUBMITTALS

A. Product Data: For each type of flagpole required. Include installation instructions.

B. Shop Drawings: Show general layout, jointing, grounding method, and anchoring and supporting systems.

1. Include details of foundation system for ground-set poles.

C. Structural Calculations: For flagpoles indicated to comply with design loadings, include structural analysis data signed and sealed by the professional engineer responsible for their preparation, registered in the state of Florida.

D. Finish Samples for Verification: For each finished metal used for flagpoles and accessories.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each flagpole as a complete unit from a single manufacturer, including fittings, accessories, bases, and anchorage devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy kraft paper or other weather tight wrapping and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 PERFORMANCE

A. Design flagpole assemblies including anchorage, foundation and supports to withstand the project specific effects of gravity and wind loads.

1. Wind loading: As Indicated.

2.2 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:

1. Baartol Co., Inc.
2. Eder Flag Manufacturing Co., Inc.
3. Concord Industries

2.3 FLAGPOLES

A. Aluminum Flagpoles: Fabricate from seamless, extruded tubing complying with ASTM B 241, alloy 6063, with a minimum wall thickness of 3/16 inch. Heat treat after fabrication to comply with ASTM B 597, temper T6. Provide cone-tapered flagpoles fabricated from seamless extruded tubing. Provide steel bottom and support plate, steel ground spike, steel centering wedges. Galvanize steel after assembly. Construct flagpole in one piece.

1. Flagpole Interior Finish: Treat the interior to prevent corrosion.
2. Exposed Height: As indicated.

B. Foundation Tube: Galvanized corrugated-steel foundation tube, 0.0635-inch minimum wall thickness, sized to suit flagpole and installation. Provide with 3/16-inch steel bottom plate and support plate; 3/4-inch- diameter, steel ground spike; and steel centering wedges all welded together. Galvanize steel parts, including foundation tube, after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.

C. Flashing Collar: Match Flagpole.

2.4 FITTINGS

A. Finial Ball: Manufacturer's standard flush-seam ball, sized to match pole-butt diameter.

1. 0.063-inch cast aluminum, with clear anodic finish. Manufacturer’s standard flush-seam ball, match flagpole butt diameter. Spun aluminum with gold anodic finish.

2. Exposed chrome plated Bronze Halyard swivel snap hooks, with braided polypropylene halyard, cleat with lockable cover box, external stationary truck assembly.

B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

1. Halyard Flag Snaps: Stainless-steel swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.
2. Plastic Halyard Flag Clips: Made from injection-molded, UV-stabilized, acetal resin (Delrin). Clips attach to flag and have two eyes for inserting both runs of halyards. Furnish two per halyard.

2.5 MISCELLANEOUS MATERIALS

A. Concrete: Provide concrete composed of portland cement, coarse and fine aggregate, and water mixed in proportions to attain a 28-day compressive strength of not less than 3000 psi, complying with ASTM C 94.

B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

C. Sand: ASTM C 33, fine aggregate.

D. Flags: Owner furnished.

2.6 FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

B. Manufacturer's Standard treatment for interior to prevent corrosion.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare in-ground flagpoles by painting below-grade portions with a heavy coat of bituminous paint.

B. Excavation: For foundation, excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure forms, foundation tube, fiberglass sleeve, or anchor bolts in position, braced to prevent displacement during concreting.

D. Place concrete immediately after mixing. Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than 7 days or use a nonstaining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to base perimeter.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.

B. Foundation-Tube Installation: Install flagpole in foundation tube, seated on bottom plate between steel centering wedges. Plumb flagpole and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric sealant and cover with flashing collar.

END OF SECTION 10 75 00

Division 11

Equipment

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SECTION 11 31 00
APPLIANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Full-Size Refrigerator/ Freezer with Ice Maker.
2. Full-Size Refrigerator/ Freezer without Ice Maker.
3. Under-counter Ice maker.
4. Under-counter Refrigerator.
5. Dishwasher.
6. Drop-In Range.
7. Range Hood.
8. Microwave.
9. Disposer
10. Washer.
11. Dryer.
12. Commercial washer.
13. Commercial dryer.
14. Ice machine.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, dimensions, furnished accessories, and finishes for each appliance.

B. Product Certificates: For each type of appliance, from manufacturer.

C. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

D. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain appliances from single source.

C. Regulatory Requirements: Comply with the following:

1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.

1.5 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

B. Full warranty including parts and labor for on-site service on the product.

1. Warranty Period: One year from date of Substantial Completion.

1.6 WARRANTY - LAUNDRY EQUIPMENT

A. Washer-Extractor: five years on frame, back gable, wash cylinder two years on all other parts

B. Dryer: two years on parts.

PART 2 - PRODUCTS

2.1 RESIDENTIAL APPLIANCES

A. Acceptable Manufacturers:

1. Amana/Speed Queen.
2. Frigidaire.
3. GE Appliances by General Electric Company.
4. Hotpoint.
5. Magic Chef.

B. Full-Size Refrigerator/ Freezer with Ice Maker.

1. Type: Top Freezer.
2. Minimum Capacity: 21.7 cu ft.
3. Include internal ice-maker.
4. Provide refrigerator door lock at clinic.
5. Power: 120v/60 Hz.
6. Size: 33” x 31.6” x 67.5”.

C. Full-Size Refrigerator/ Freezer without Ice Maker.

1. Type: Top Freezer.
2. Minimum Capacity: 21.7 cu ft.
3. Provide refrigerator door lock at clinic.
4. Power: 120v/60 Hz.
5. Size: 33” x 31.6” x 67.5”.

D. Under-counter Refrigerator.

1. Minimum Capacity: 5.5 cu ft.
2. Power: 115v/60 Hz.
3. Size: 32” x 24” x 23”.

E. Dishwasher.

1. ADA Compliant; under-counter.
2. Material: Stainless Steel tub and door liner.
3. Power: 120v/60 Hz.
4. Color: White.
5. Size: 24” x 24” x 33”.

F. Drop-In Range.

1. Minimum Capacity: 4.4 cu ft.
2. Type: Self-cleaning.
3. Fuel Type: Electric.
4. Burner Type: Radiant; Smooth-top.
5. Cooktop Surface: patterned Ceramic Glass.
6. Color: White.
7. Size: 27” x 28.5” x 31.25”.

G. Microwave Range Hood.

1. Ducting: 4-way (7” round).
2. Color: White.
3. Size: 30”
4. Capacity: 2.0 cu ft.
5. Turntable size: 16 in.
6. Power: Electric, 1200 w.

H. Disposer.

1. Power: ¾ hp.
2. Grinding speed: 3500 rpm.
3. Turntable: Stainless Steel.
4. Control: Wall Switch.
5. Color: White.

I. Commercial Washer.

1. Minimum Capacity: 3.4 cu ft.
2. Max Spin Speed: 700 rpm.
3. Fuel Type: Electric.
4. Power: 120v/60 Hz.
5. Basket Material: Stainless Steel.
6. Color: White.
7. Size: 27” x 26” x 43”.

J. Commercial Dryer.

1. Minimum Capacity: 6.5 lb.
2. Fuel Type: Electric.
3. Power: 120v/60 Hz.
4. Color: White.
5. Size: 29” x 28” x 42.5”.

2.2 COMMERCIAL WASHING /DRYING EQUIPMENT

A. Acceptable Manufacturers:

1. Dexter.
2. America Dryer Corp.
3. Other Manufacturers as approved by the Owner.

B. Washer - Extractor

1. Approved manufacturers are Speed Queen, Model No. (refer to drawings for current model number), Washing Machine with 740508 8” base as supplied by Star Laundry Equipment, Belco Athletic Laundry Equipment Co., or as approved, Model No. "50", 50 lb. capacity, UL approval label, and door safety lock. One washer-extractor required for each washer.

2. Also acceptable: Star Laundry Equipment, Speed Queen Model (refer to drawings for current model number), WASHING MACHINE with 740508 8” base and ST50CE CLOTHES DRYER-check for availability in gas.

3. Construction

   a. Tub, front door, top & front panels to be stainless steel.
   b. Frame to be extra heavy duty galvanized steel.
   c. Other materials are to be of non-corrosive materials.

4. Soap Dispenser

   a. An automatic system with "Delayed Flush".
   b. Liquid Flow Soap / Lever Brothers.

5. Controls

   a. Fully electronic automatic, removable by quick disconnect plugs.

6. Voltage

   a. 277/480V / 60Hz / 3 Phase

C. Dryer

1. One dryer required in Laundry Room as shown on Architectural Drawings.
2. Approved manufacturers are Speed Queen ST50CE, Belco Athletic Laundry Equipment Co., or as approved, Model No. "50", 50 lb. capacity, UL approved label, natural gas heated and shall have an insulated cabinet in manufacturer's standard finish.
3. Controls

    a. Fully automatic with removable control panel by quick disconnect plugs with the following control features:

        1) Hi Temp - Towels - 180 degrees
        2) Lo Temp - Game uniforms - 100 degrees
        3) PP - Practice uniforms - 140 degrees
        4) Start

4. Timer: 60 minutes to include a 5 minute "Cool Down" period.
5. Exhaust Vent: minimum 6" diameter galvanized steel, 1000 CFM, with exterior weather cap and damper.
6. Voltage: 110V / 60Hz / 1 Phase.

2.3 ICE MACHINES

A. Acceptable Manufacturers:

1. Hoshizaki.
2. Manitowoc.
3. Other Manufacturers as approved by the Owner.

B. Commercial Ice maker for athletic training room.

1. Production: Up to 760 lb/day.
2. Flake ice for Training Room Only.
3. Power: 208v, 60 Hz, 13 amps.
4. With storage bin and filter.
5. Size: 30” x 24” x 29”.

C. Field House Ice Maker.

1. Basis of Design Product and Manufacturer; Scotsman C0330MW-1 Prodigy Plus Series, 30” Water Cooled Medium Cube Ice Machine and Ice Storage Bin - 420 lb.

D. Under-counter Ice Maker.

1. Basis of Design Product and Manufacturer; Manitowac, SM50A Undercounter Octagonal Cube Ice Machine with 25 lb. Bin - 53 lb.

    a. Power: 115v /60 Hz.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Utilities: See Divisions 22 and 26 for plumbing and electrical requirements.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Operational Test: After installation, start units to confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

C. An appliance will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 11 31 00

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SECTION 11 40 00
FOODSERVICE EQUIPMENT

TABLE OF CONTENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section describes bidding, furnishing, installing, adjusting, testing and warranting the food preparation, cooking, serving, washing, and storage equipment.

1.2 DEFINITIONS

A. Foodservice Equipment Contractor (FSEC) and Kitchen Equipment Supplier (KES) shall be used interchangeably in all documents and shall refer to the party that has been awarded the foodservice equipment contract.

B. Consultant and Foodservice Consultant shall be used interchangeably in all documents and shall refer to the party contracted by the Architect to create the Foodservice Equipment Plans and bid documents.

C. General Contractor shall refer to the party responsible for the construction of the foodservice facility. The term shall also refer to the trades, other than the FSEC, that have been contracted by the General Contractor to complete his work (i.e., Electrical Contractor, Plumbing Contractor, etc.).

D. Foodservice Equipment and Kitchen Equipment shall be used interchangeably in this Section.

1.3 KES REQUIREMENTS AND SCOPE OF WORK

A. The Kitchen Equipment Supplier shall be registered to do business and have its primary offices in the same State where the project is.

B. The KES' scope of work shall include:

1. Review contract drawings and submittal data for accuracy and completeness.
2. Furnish foodservice plans and documents per submittal instructions in Sub-Part 1.08 in this Section.
3. Field verify all horizontal and vertical dimensions required to ensure proper fit of equipment.
4. Field verify installed utility capacity and locations.
5. Coordinate mechanical and electrical rough-ins, depressed areas, raised bases wall openings, and other special conditions required to accommodate equipment in this contract, including any Owner furnished equipment.
6. Advise the General Contractor of any/all discrepancies within foodservice documents and/or between foodservice documents and A/E documents prior to ordering equipment.
7. Notify General Contractor of any special backing or reinforcement needed. Locate such backing or reinforcement. Said backing or reinforcement shall be supplied and installed by the General Contractor as per Sub-part 1.06 of this section.
8. Furnish data necessary for proper location and sizing of the mechanical connections for the foodservice equipment.

9. Furnish, deliver, uncrate, assemble, erect, set-in-place, install, relocate, level, and test the equipment specified in this Section as indicated on the foodservice equipment drawings.
10. Provide all accessories with equipment, whether specified or not, in order to comply with all governing codes and to make equipment fully operational.
11. Furnish stands and supports for foodservice equipment, requiring such supports, not specified in Part 4 of this Section.
12. Furnish labor, materials, and equipment to perform the work required by the drawings and specifications.
13. Furnish faucets, wastes, or lever wastes, where specified, for sink units.
14. Furnish switches, starters, controls, and contractors on foodservice equipment as specified.
15. Furnish to the General Contractor any foodservice equipment parts to be built into the general construction work in ample time for their inclusion in the construction work. Furnish necessary setting plans and instructions for the installation of these parts.
16. Communicate and coordinate with the General Contractor to ensure proper performance of work in this Section.
17. Cut holes in the equipment for pipes, drains, electrical outlets, etc., required for the work of this Section. This work shall include welding of sleeves, collars, ferrules, and escutcheons. See Part 3 in this Section for additional information.
18. Repair damage to the premises resulting from work of this Section at no additional cost to the Owner.
19. Test, regulate and demonstrate that all equipment has been installed properly and is working properly in accordance with Sub-Part 3.07 of this Section.
20. Remove cartons, crates, skids, packing materials and other debris resulting from this installation.
21. Perform all work in accordance with applicable laws, codes, ordinances, and regulations.
22. Obtain an inspection certificate from local authorities and/or any governing body as required at no cost to the Owner.
23. Deliver all certificates of acceptance or completion to the Owner as required by the governing State or Municipal agencies and/or other governing authorities. Owner may withhold payment until all necessary certificates are obtained and delivered to Owner.
24. Furnish all safety devices required to comply with the aforementioned regulations regardless of whether or not specified or called for in the following technical divisions of the equipment list schedule.
25. Warranty all work according to the terms in Sub-part 3.10 of this Section.

1.4 INTENT OF CONTRACT DOCUMENTS

A. The documents are intended to indicate the desired basic arrangement and dimensions of the equipment, acceptable manufacturers and models, equipment-specific mechanical, electrical and plumbing requirements, and details specific to the successful installation of equipment. Review and verify the completeness and correctness of the bid documents before bidding. The Kitchen Equipment Supplier shall notify the General Contractor, in the prescribed manner, of any omissions or discrepancies PRIOR to the bid submission. The lack of such notification shall be construed as complete acceptability of the documents and as waiving rights to future claims against Consultant arising from unreported omissions or discrepancies.

B. The documents are to be used collectively, in that, if in Part 4 of this Section a stock model has been specified but does not meet certain specifications of Part 2 of this Section then the KES shall consider that item to be a “SPECFAB” item and shall ensure that it meets the all fabrication criteria contained in Part 2 of this Section.

C. The Kitchen Equipment Supplier shall be held responsible and liable for all changes or variances from Contract Documents, i.e., Plans, Specs, Addendum, without written authorization from Architect for said changes or variances.

1.5 PRICING

A. Pricing shall consist of itemized individual prices, costs for freight, installation, and taxes.

1.6 RELATED WORK ELSEWHERE

A. The work listed below is related to the proper installation of the equipment but shall be completed by trades other than the Foodservice Equipment Contractor. It shall be the responsibility of the Kitchen Equipment Supplier to communicate and coordinate with the General Contractor to ensure performance of the following work:

1. Furnish all electrical, plumbing, and mechanical rough-ins, including final connections and hook up services.
2. Furnish wiring, line switches, safety cut-outs, control panels, contactors, fuse boxes or other related electrical controls or fittings except as specified to the contrary under individual items listed in Part 4 of this Section.
3. Furnish all faucets, special switches, valves, traps, labor, and materials to make final connection to equipment, as so specified in other sections of the Architect's specifications, unless specifically specified otherwise in Part 4 of this Section.
4. Furnish grease interceptors, shut-off valves, trim traps, and related fittings, except as specified to the contrary under individual items listed below.
5. Construct concrete bases and floor depressions as specified.
6. Furnish backfill of concrete or mortar after erection of walk-in cooler/freezer units.
7. Furnish platforms for equipment or other on roof support systems for the equipment located thereon unless otherwise specified to be part of the work of this Section.
8. Furnish wall backing where specified is to be supplied and installed by the GC. When necessary, the GC shall extend the width of wall backing to the next stud beyond the width shown on the wall backing plan.
    a. Wall backing for stud walls shall be 3/4" plywood.
    b. Wall backing for hood wall shall be 14-gauge galvanized steel.
9. Furnish and install the gas, water, sewer, direct waste, and drainage piping unless specifically called out to be a part of the work of this Section.
10. Furnish accessible vacuum breakers located above ceiling.
11. Furnish and install ventilation components and ducts, including hood or ventilator ductwork upstream from ceiling or connection position, except as specified to the contrary under individual items in this Section.
12. Install ventilation hoods, fans, fan curbs and ductwork provide by the Foodservice Equipment Contractor.

13. Furnish wiring circuits from exhaust ventilator control panels, fire protection systems, and to exhaust fan controls.
14. Locate and install remote pull station for ventilator hood(s).
15. Furnish an accessible manual gas shut off valve at or near hood.
16. Furnish and install conduit and wire to the point of rough-in for the equipment including required disconnect switches.
17. Furnish Building Automation System wiring to walk-in cooler and freezer for temperature monitoring.

B. It shall be the responsibility of the General Contractor to coordinate and/or identify any discrepancies where foodservice documents refer to other Sections, Architectural plan(s) or MEP plan(s) for reference or specification.

1. Any discrepancies found between the documents shall be brought to the attention of the Architect for clarification prior to construction or installation of mechanical, electrical or plumbing systems.

1.7 REFERANCE STANDARDS AND CODES

A. NFPA: Cooking equipment shall conform to the applicable requirements of standard for Vapor Removal from Cooking Equipment, NFPA 13 and 96.

B. AGA: All gas fired equipment shall comply with requirements of A.G.A. and shall bear its seal of approval.

C. UL & ANSI: Electrically operated or heated and refrigerated equipment, fabricated or not, shall conform to the standards of the Underwriters Laboratories and ANSI.

D. AWS: Welding shall be performed in accordance with the applicable requirements of American Welding Society Code, AWS D1.1 and D9.1.

E. ASME: All pressure steam vessels (i.e. boilers, kettles, etc.) shall comply with A.S.M.E standards and bear its seal of approval. In addition, they shall also comply with any and all requirements of the State Boiler Inspector including permits and inspections.

F. NSF: Equipment pieces shall be manufactured in compliance with Standards No. 3, 4, 5, 6, 7, 8, 12, 18, 20, 26, 29, 35, 37 & 51, where applicable, of NSF Testing Laboratories and bear the Seal of Approval. This shall include any pending standards which will become applicable at the time equipment is delivered. Special fabrication items such as sinks, worktables, counters, etc., shall be manufactured in compliance with Standard No.2 of the National Sanitation Foundation Treating Laboratory, and shall bear the NSF Seal of Approval.

G. Walk-in refrigerator and freezer rooms or other 'built-in" pieces of equipment shall be designed, fabricated, and installed in strict compliance with Standard of the National Sanitation Foundation, Underwriters Laboratories, ANSI, applicable state building codes or the local authority having jurisdiction. This equipment shall also comply with all other applicable codes.

H. ENERGY STAR: Where possible and unless otherwise specified in this Section, electrically operated equipment shall meet or exceed Energy Star Efficiency Ratings.

I. Complete compliance with legally constituted authorities having jurisdiction, including all applicable portions of General Industry Safety Orders, Public Health Services, State Fire Marshall, Local and State Building codes and Ordinances, is required.

1.8 SUBMITTALS

A. Document Submittals

1. Submit in accordance with applicable requirements of Division 1, giving all data for the correlation of the work with other trades.
2. Make submission of all submittal documents listed in this Sub-Part to the Architect through the General Contractor.
3. Submittal must be complete. Partial submittals will not be accepted.
4. Within thirty (30) days after award of contract, KES shall submit one (1) PDF set of dimensional drawings for review as follows:

    a. Foodservice Equipment Plan(s)
    b. Foodservice Equipment Schedule(s)
    c. Foodservice Equipment Electrical, Plumbing and Mechanical Rough-in Plan(s)
    d. Foodservice Equipment Wall Backing Plan(s)
    e. Foodservice Equipment Elevation(s)
    f. Product Data Booklet containing manufacturer's descriptive and technical literature, accessories and warranty information with item numbers that correspond with Foodservice Equipment Schedule.

5. Within forty-five (45) days after award of contract, KES shall submit one (1) PDF set of dimensional drawings for review as follows:

    a. Foodservice Equipment Hood Shop Drawing(s)
    b. Foodservice Equipment Walk-in Cooler/Freezer Drawing(s)
    c. Foodservice Custom Fabricated Equipment Shop Drawings(s)

6. Provide detail drawings showing complete wiring, piping, and schematic diagrams, and any other details required to demonstrate that the system is coordinated and properly functions as a unit.
7. Submittal drawings must be separate drawings, prepared from the Architect's dimensioned plans, not reproduced from the Foodservice contract drawings, DWG files or Revit files and be the Architect's standard sheet size, but not smaller than the contract drawings, indicating foodservice equipment and cold storage assemblies with itemized schedule, special conditions drawings indicating size and location of slab depressions, cores, wall openings, block outs, ceiling pockets, blocking grounds, ceiling or wall, access panels, rough-in plumbing/mechanical systems and rough-in electrical systems.

    a. Equipment plan(s), rough-in drawing(s), wall backing plan(s) and elevations shall be provided at a scale no less than 1/4”=1’-0”
    b. Shop drawings for walk-in(s) and hood system(s) shall be provided at a scale of no less than 1/2”=1’-0”
    c. Shop drawings for fabricated equipment shall be provided at a scale of no less than 3/4”=1’-0”

8. Detail drawings by manufacturer must be separate drawings; manufacturer's standard size and indicate item number, name, and quantity, construction details, sections, and elevations, adjacent walls, columns, and equipment, plumbing and electrical schematics, and fabricated fixtures with single electrical or plumbing connection, and service access panels required for maintenance or replacement of mechanical or electrical components.
9. Drawings must show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work, including clearances for maintenance and operation.
10. Each item of Foodservice Equipment shall be the size, shape and type indicated on the drawings and in Part 4 of this Section.
11. Each item of Foodservice Equipment shall be of the latest model available at the time of the submittal. The KES shall notify the General Contractor and receive approval from the Consultant in writing when he is furnishing a later model than the one specified.

    a. Revisions or changes shall be accomplished at no additional expense to the Owner.
    b. Changes in electrical, plumbing, or mechanical requirements shall be coordinated with the GC by the KES.

12. Any discrepancies found between the specifications and the drawings, or between drawings, or any contradictory sizes shall be brought to the attention of the General Contractor for clarification prior to the preconstruction submittal.

B. Approvals

1. The approval of the shop drawings and schedules by the Architect and/or his Consultant will be general and shall mean that the Architect has no objections to the use of the materials and processes shown. The Architect's/Consultant's approval shall not relieve the Kitchen Equipment Supplier from his responsibility for errors or omissions or any deviation from the contract requirements.

C. Alternates or Substitutions

1. Alternates of substitutions prior to bidding shall be as follows:

    a. The manner of submission for prior approval shall be as directed by the General Contractor.
    b. Suggested alternates or substitutions of equipment not already listed in Part 4 of this Section may be submitted but only by prior approval before bidding.
    c. When an item of equipment is submitted for prior approval, a manufacturer's specification sheet or detailed description of the matter in which the prior approval item conforms or varies from the item specified shall be furnished.
    d. All substitutions must be submitted in writing and approved by the Architect and his Consultant.
    e. Alternates and/or substitutions will not be acceptable unless evidence is presented to the Consultant that equipment of approximately the same type and design as the specified equipment has been installed elsewhere and has been operation successfully for at least one year.
    f. The KES shall assume responsibility as to the quality of the proposed alternate, regardless of any approval by the Architect, Consultant or General Contractor.

Should the alternate item prove to be unequal to the originally specified item, the KES shall replace the alternate item with the originally specified item of equipment at no additional expense to the Owner.

2. Alternates of substitutions after award of contract shall be as follows:

   a. Substitutions submitted and approved that have mechanical, plumbing, or electrical characteristics which are different than the drawings and specifications are the responsibility of the KES to coordinate with the General Contractor. All costs for approved changes shall be borne by the KES.
   b. Should the substitution of equipment require rearrangement in the room or change the rough in and services, a layout of such changes shall be submitted with the shop drawings. Such rearrangement shall result in no additional expense to the Owner.

D. Operating and Maintenance Instructions

1. Upon completion of the installation, the KES shall present to the Owner the following:

   a. Demonstration and training of the use, care and maintenance of foodservice equipment to the proper personnel.
   b. One (1) set of PDF copies of complete booklets containing instructions, warranties and parts list of all equipment furnished under this section. The front of the manual shall list names, addresses and telephone numbers of the local service companies for those items having mechanical and electrical components that may need servicing.
   c. Instruction and/or maintenance videos for all equipment when available.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials used in the fabrication of this work shall be new and the best grade obtainable of their respective type and shall be finished so as to be easily cleaned, resistant to wear, denting, pitting, chipping, and/or grazing, and shall withstand penetration of vermin and corrosive action of foods and compounds.

B. Unless otherwise specified in Part 4 of this Section, provide fabricated stainless-steel equipment using the following gauge specifications:

1. Worktable Tops: Not less than 16-gauge stainless steel.
2. Legs: Not less than 16-gauge stainless steel.
3. Sink Top and Splashes: Not less than 14-gauge stainless steel.
4. Floor Troughs: Not less than 14-gauge stainless steel.
5. Support Channels: Not less than 14-gauge stainless steel.
6. Undershelves: Not less than 18-gauge stainless steel.
7. Overshelves and Wall Shelves: Not less than 16-gauge stainless steel.
8. Enclosed Cabinet Body: Not less than 18-gauge stainless steel.

9. Cabinet Doors: Not less than 18-gauge stainless steel.
10. Drawers: Not less than 20-gauge stainless steel.
11. Drawer cradles: Not less than 16-gauge stainless steel.

C. Stainless Steel, Sheets and Formed, Non-magnetic

1. Unless otherwise specified in Part 4 of this Section, Stainless steel fabrication shall be type 304 extra low carbon, non-magnetic, Austenitic 18% chromium, 8% nickel corrosion resistant alloy steel, flat, free of all buckles and surface imperfections and shall be non-magnetic and must meet the requirements of the American Iron and Steel Institute Designations for Type 304 Stainless Steel.
2. Unless otherwise specified in Part 4 of this Section, type 430 Stainless Steel will not be acceptable for custom-built fabricated equipment and no material lighter than 20 gauge shall be incorporated into the work.

D. Stainless Steel Pipe, Tubing and Bars

1. Stainless-steel pipe and tubing shall be seamless of gauge specified and of true roundness. Seamless tubing shall be thoroughly and correctly annealed and ground smooth.
2. Welded tubing shall be thoroughly heat treated smooth.
3. Welded tubing shall be thoroughly heated and properly quenched to eliminate precipitation, drawn true to size and roundness and polished to match stainless steel sheets.

E. Non-stainless steel structural steel members.

1. Where specifically allowed for framing consisting of angle, bars, channels, etc., shall be ductile in quality, free of hard spots, runs, checks, cracks, and other surface defects.
2. They shall be smooth and galvanized by the hot dip process with all surpluses removed and free of runs, blisters, excess spelter and uncoated spots or patches.
3. Cut edges and exposed members of non-stainless-steel framework and wrought steel pipe, where allowed, must be cleaned, and free of foreign matter before applying a rust inhibiting prime and two coats of epoxy-based paint.

F. White metal or decorative metals.

1. White metal shall consist of corrosion resistant metal containing not less than 30% nickel.
2. Castings shall be rough ground, polished, buffed to bright luster, free from pit marks, runs, checks, burrs, and other imperfections.
3. In lieu of white metal castings, 18-8 stainless steel die-stamped, or casting will be acceptable.

G. Lead-Free Solder

1. ASTM B32, 95.5 tin-antimony solder or other "lead-free" solder. Use for all potable water copper tubing and fitting connections, and for solder joints in contact with food.

H. Sealants

1. Sealants must conform to the requirements of ASTM C1330, ASTM C920.

I. Laminated Plastics

1. See Division 6 Section “Finish Carpentry” and/or Division 12 Section “Institutional Casework” for material specification and fabrication and application techniques.

J. Solid Surface Material

1. Solid surface material used in a foodservice application must conform to NSF Standards.
2. See Division 12 Section “Institutional Casework” for material specification and fabrication and application techniques.

2.2 CONSTRUCTION OF FABRICATED EQUIPMENT

A. It is required that all fabricated equipment such as serving counters, worktables, sinks, counter tops, etc., described Part 4 of this Section, other than by name and catalog numbers, be manufactured by custom-built fabricator who has the plant, personnel, and engineering facilities to properly design, detail and manufacture high quality food service equipment.

1. All work in the above category to be by one fabricator and of standard unit assembly and uniform design and finish.
2. Fabricator must have a minimum of five (5) years of experience in this work.
3. Fabricator shall have the proper NSF certification and installer shall have all proper licenses for such work.
4. The prospective bidder for the equipment hereinafter specified shall be a recognized distributor for these items of equipment.
5. Upon demand, bidders being considered for possible negotiation shall submit to the Architect evidence of having executed contracts of a size comparable to this Contract.

B. Construct each piece in a workmanlike manner to include all necessary reinforcing, bracing, and welding; and the proper number and spacing of uprights and crossmembers for strength as set forth in the standard drawings and specifications and for the heavy-duty commercial use intended.

C. Wherever size permits, equipment shall be fabricated of a single sheet of metal.

D. Equipment not braced in a rigid manner which is subject to bending, warping, rattle, wobble, or tin-canning will not be acceptable.

E. In general, shop fabricated fixtures of one-piece construction, shall be shipped to the job completely assembled. Equipment too large to transport or enter the building as one piece shall be constructed so that welded field joints can be made at the job site.

F. Suitable pipe slots shall be provided throughout all undershelves to accommodate necessary service lines. These slots shall be of proper size and shall be neatly made with turned up edges on all four sides to eliminate cutting or defacing of equipment on job. Cabinet bodies shall be provided with an inner panel duct at ends or rear of cabinet to allow vertical pipe space to conceal the vertical piping.

G. Grinding, Polishing, and Finishing

1. Grind smooth all exposed welded joints and finish to match the adjoining material.
2. Wherever materials have been depressed or sunken by welding operation, finish such depressions to be flush with the adjoining surface, and again grind to eliminate high spots.
3. Polish and buff ground surfaces to match adjoining surfaces.
4. Exercise care in the grinding operations to avoid excessive heating of the metal and metal discoloration.
5. Abrasives, wheels, and belts used in grinding must be free of iron and not previously used on carbon steel.
6. In all cases, the grain of rough grinding must be removed by several successively finer polishing operations.
7. Final polishing operation must be uniform, smooth, and consistent. Make the grain direction of horizontal stainless-steel surface longitudinal, including the splash back.
8. Provide a mitered appearance when polishing at right angle corners. Provide close fit butt and contact joints not requiring solder as a filler.
9. Wherever brake bends occur, the bends must be free of open texture or orange-peel appearance. Where brake work does mar the uniform appearance of the material, remove such marks by grinding, polishing, and finishing.
10. Wherever sheared edges occur, they shall be finished to alleviate all danger of cutting or laceration when the hand is drawn over such sheared edges. Make sheared edges free of burrs, projections, and fins.
11. Provide No.4 finish for all exposed stainless-steel surfaces. Finishes of materials, other than stainless steel, must be comparable in appearance to commercial mill finish.
12. Exposed surfaces include:

    a. Exterior surfaces exposed to view.
    b. Interior surfaces exposed to view in doorless cabinets.
    c. Undersides of shelves with a ground finish of No. 90 grit or finer.
    d. Support channels subject to exposure to water, soap, and chemicals from high pressure hose system.

13. The grain of polishing shall run in the same direction on all horizontal and all vertical surfaces of each individual item of fabricated equipment.

    a. When stainless-steel sheets have grain running in difference directions, the sheets shall be joined at a miter joint and the welds run and finished in such a manner as to make the sheets appear as one continuous product.
    b. Where miters or bullnosed corners occur, finish such miters and corners with the underage of the material and grind to a uniform condition.
    c. In no case are over-lapping materials to be acceptable where miters or bullnosed corners occur.
    d. Where sinks and adjacent drainboards are equipped with a back splash, the grain of polishing shall be consistent in direction throughout the length of the back splash and sink compartment.

H. Fastening Devices

1. Provide fastening devices of the same material as the metal being joined when joint pieces are of similar metal.
2. Fastening devices must be stainless steel, ASTM A666 when stainless steel is joined to dissimilar metal.
3. Provide minimum M6 (1/4-20) stainless steel stud bolts with length necessary to accept washers, and required nuts, and weld 9 inches on center maximum

a. Such bolts must be the concealed type.

4. Cap threads of stud bolts which are on the inside of fixtures and are either visible or might come in contact with a wiping cloth, with chrome plated washers, lock washers, and chromium-plated brass cap nuts.
5. Wherever bolts are welded to the underside of trim or tops, uniformly finish the reverse side of the welds with the adjoining surface of the trim or the top. Dimples at these points are not acceptable.
6. Where bolt or screw heads on the interior of fixtures are visible or may come in contact with hands or wiping of cloths, they must be capped with an acorn nut with lock-washer.
7. Exposed surfaces shall be free from bolt, screw, and rivet heads.

I. Welds and Welding

1. The term "Fully Welded" as used in Part 4 of this Section disallows the use of stud bolts to be used to fasten tops of counters, tables or wall shelves to angle or channel framing, supports and/or trim to other surfaces.
2. Welding shall be of electric arc or oxy-acetylene gas. Use filler metal compatible with the material being welded. Make welds ductile and of same color as adjoining surfaces.
3. Butt joints and contact joints, wherever they occur, shall be close fitting and shall not require solder as a filler.
4. Wherever break bends occur they shall be free of undue extrudence and shall not be flaky, scaly, or cracked in appearance and where such breaks do mar the uniform surface appearance of the material, all such marks shall be removed by suitable grinding, polishing, and finishing.
5. Perform all welding with welding rods of the same composition as the sheets or parts welded.
6. Factory weld long section components to the greatest lengths possible to minimize field welded joints.
7. Weld quality must conform to the requirements of AWS A5.8/A5.8M, AWS D1.1/D1.1M, AWS D10.4 and AWS D9.1M/D9.1.

J. Sound Deadening of Counters and Sinks

1. Provide sound deadening for underside of worktables, counter tops and sinks.
2. Spray on products by 3M Corporation or Dow Corning used for sound-deadening are acceptable.

K. Sinks, Drainboards and Dishtables

1. Form drainboards and draintables integrally with the sink bowls in the same unit, be of the length and width specified or indicated on the drawings and be sloped to the sink a minimum of 1/8 inch per foot.
2. Unless otherwise indicated, the rims of the drainboards shall be 1-1/2 inches with a rolled rim with exterior corners bullnosed.

3. Where one or more sink compartments are adjacent, the partitions shall be double thickness, continuously welded where the sheets join at the top; crease the bottom of each compartment to insure complete drainage to the waste opening.
4. Leg assembly of sinks shall be fully welded with appropriate cross bracing. No bolted leg assemblies shall be accepted.
5. All prep and pot sinks shall be fitted with lever waste valves and stainless-steel strainers unless otherwise specified in Part 4 of this Section. Provide waste handle brackets beneath sink bowl(s).
6. Furnish and install all waste tail pieces incorporate in the custom fabricated food service equipment. All wastes being furnished shall be provided with chrome plated tail piece.
7. Overflows shall be included for pot sinks.

L. Pass-Thru Windows/Openings

1. Fabricate a mitered window frame of 14-gauge type 304 stainless steel channel forming a 3.5-inch casing on each side of wall. Return flange 1/2 inch to wall. Weld joints; join only at corners of opening. Mount, trim and seal as required.
2. This work shall be coordinated with the GC.
3. Field measurements must be verified prior to fabrication.

M. Metal Tops and Work Surfaces

1. Metal tops and work surfaces shall be ground polished stainless steel in the gauge specified under Sub-part 2.01(B) in this Section.
2. Apply sound deadening according to Sub-Part 2.02(J) of this Section.

N. Backsplashes and Side splashes

1. Backsplashes and side splashes shall be integrally fabricated of the same type and gauge material as the countertop and shall be provided with closed ends.
2. Backsplashes shall be provided in a thickness no less than 1 inch and no more than 2 inches.

    a. One-inch splashes may return to wall at 90 degrees; Two-inch splashes shall have an upward angled return to wall of 45 degrees.

3. Backsplashes shall have no exposed fasteners for securing to wall.

O. Undershelves (in tables)

1. Construct undershelves shall be ground polished stainless steel in the gauge specified under Sub-part 2.01(B) in this Section.
2. Turn down the front edge of the intermediate shelves 1-1/2 inches and then back 1/2 inch at a 45-degree angle or provide hemmed edge.
3. Turn backsides up 1-1/2 inch.
4. Provide a marine edge only where specified in Part 4 of this Section.

P. Enclosed Cabinet Body

1. Cabinet bodies shall be constructed in the materials and gauges specified in this Section and of welded construction throughout with front rails, mullions, etc., welded to appear as one-piece construction.
2. Close vertical mullion sections, forming a four-sided and completely enclosed mullion.

Q. Cabinet Doors

1. Cabinet doors shall be a minimum of 7/8 inch thick and fitted with a continuous stainless-steel pull, matching those specified for drawers, and have rubber bumpers.
2. Construct doors with double pan construction having corners welded, ground and polished.
3. Insulate between pans.
4. Tack weld the pans together.
5. Polish the exterior and interior of the doors to a No.4 finish.
6. Hinged doors shall be the flush type mounted on heavy duty concealed hinges and fitted with magnetic catches.
7. Install strike plate on the fixture body so as not to interfere with the use of the shelf area.
8. Sliding doors shall be fitted with ball-bearing roller glides and be removable without the use of tools.

R. Cabinet Undershelves

1. Turn down the front edge of the cabinet shelves 1-1/2 inches and then back a minimum of 1/4 inch at 45 degrees or provide a hemmed edge.
2. Turn backsides up and feather slightly to form a tight fit to the enclosure panels.

S. Drawers

1. Drawers shall be removable pan type supported by a drawer cradle and enclosed in an enclosed housing.
2. All vertical and horizontal corners shall have a 3/4-inch minimum coved radius.
3. Provide the drawer front with a continuous stainless-steel pull, matching those specified for doors.
4. Support the drawer cradle with stainless steel roller bearing slides with stops mounted to make the drawers self-closing.
5. Construct slides to permit each drawer to be pulled out at least two-thirds of its length and support heavy loads without deflection.
6. The drawer cradle shall be removable without tools.

T. Hardware and Locks

1. Hardware shall be of chromium-plated cast brass. Stampings shall not be used.
2. When specified, fit drawers and cabinet doors with cylinder-type locks, keyed alike and in separate groups as directed.
3. Provide master keys to open all locks in the Foodservice area.

U. Casters

1. Where casters are specified, they are to be of 5" high roller bearing construction, swivel type with non-marking rubber thread, and two (2) casters are to have locking type brakes.

2. Wheels are to be disc steel type with neoprene tires.

V. Electrical Equipment and Components

1. Foodservice equipment furnished under this section must have loads, voltages, and phases compatible with building system, and conform to manufacturer standards.
2. Fabricated equipment containing electrically operated components or fittings, indicated on utility connections drawings to be direct connected must have each component, fitting, or group thereof prewired to a junction box for final connection.
3. Furnish fabricated equipment complete with internal wiring chases where electrical services are required. Provide adequate raceways and accesses in fixtures for this work.
4. Wiring and connection diagrams shall be furnished with electrically operated machines and for electrically wired fabricated equipment.
5. Provide and install grounded receptacles specified under the Part 4 of this Section and/or as shown on the Contract Drawings.
6. Equipment mounted receptacles shall be as specified and furnished with S/S face plate.

W. Cords and Caps

1. All 120/208/240 volt "plug-in" equipment must have Type SO or SJO cord and a plug with ground, fastened to frame/body of item.

X. Switches and Controls

1. Equip each fabricated motor-driven appliance or electrically heated unit with control switch and overload protection per UL standards. Switches, controls, control transformers, starters, equipment protection and enclosures must be Industry Standards for the related equipment environment.

Y. Motors

1. Provide motors at 120, 240, 208/240 and 460/480 volts with starter, overload protection, and short circuit motor protection per manufacturer standards.
2. The electrical wiring, motors, motor starters, switches, thermostats of the equipment shall be an integral part of the unit which shall contain a junction box for connection of electrical service.
3. Motors shall be of the drip-proof, splash proof, or totally enclosed type, having a continuous duty cycle and ball bearings except small timing motors which may have sleeve bearings.
4. Motors located where subject to deposit of dust, lint, or other similar matter from the machine on which installed shall be of the totally enclosed type.
5. Motors shall have windings impregnated to resist moisture.
6. Motors shall have ample power to operate the machine for which designated under full load operating conditions without exceeding their name plate ratings.
7. Horsepower requirements on driven equipment shall be determined by the manufacturer, based on normal operation at maximum capacities. The normal rated motor horsepower shall not be less than the horsepower required for normal operation of the equipment at maximum capacity.

8. Quietness of operation of foodservice equipment is a requirement and Kitchen Equipment Supplier will be required to remove or repair any equipment producing objectionable noise and/or vibration.
9. Furnish on each motor driven appliance, or electrically heated unit, a suitable mounted control switch or starter of proper type in accordance with Underwriter's Code. All controls mounted on vertical surfaces of fixtures shall be set into recessed die-stamped S/S cups or otherwise indented to prevent damage.

Z. Heating Elements

1. Provide thermostatic controls for all electrically heated equipment unless otherwise specified in Part 4 of this Section.
2. Equip water heating equipment with a positive low-water shut-off.

AA. Refrigeration

1. Cold pans, refrigerated pans and cabinets shall be provided with breaker strips where adjoining top or cabinet face materials to prevent transfer of cold.
2. Adequate air supply and exhaust shall be provided for self-contained refrigeration condensing units, both fabricated and standard, as required for proper operation. If, in the opinion of the Kitchen Equipment Supplier , additional ventilation is required to ensure correct operation temperatures, he shall so state to the General Contractor in writing of his evaluation and decision before installation.
3. Coils for fabricated refrigerators shall have vinyl plastic coating and shall be installed in such a manner as to be replaceable.
4. Refrigerated compartments, fabricated and standard, shall be fitted with flush digital thermometers. Thermometers shall be adjustable and calibrated after installation.
5. Refrigerator hardware shall be heavy duty. Hinges shall be self-closing and latches shall be magnetic edge mount-type unless specified or detailed otherwise.
6. Refrigerators and freezers having remote refrigeration system shall be complete with thermostatic expansion valves at the evaporator. Expansion valves shall match the refrigeration and electrical requirements of the remote condensing units. Disconnect switches, automatic starting switches, motor protectors and pressure limit switch all enclosed and with interconnection wiring, shall be factory installed, ready for line connections. They also must be provided with thermostats, solenoids, pressure control, liquid line sight glass, dryer of ample capacity, a heat exchanger, and a thermostatic expansion valve for each evaporator.
7. Required racks are to be provided for mounting of remote condensers and controls. Where needed, provide removable weather-proof covers.

2.3 WALK-IN COOLER FREEZER STANDARDS

A. Furnish walk-in with approved Class I Panels. Panels shall have a Low flame spread of 25 or less and smoke density of no more than 250 complying with requirements of BOCA, SBCO and Uniform Building Code and shall have certification from an independent testing laboratory that panels comply with flame spread and smoke density requirements of above stated Building Codes.

B. Provide walk-in units manufactured for foodservice use in accordance with NSF/ANSI/UL Standards.

C. Provide complete pre-assembled remote refrigeration systems in both compartments. Provide sufficient BTUs for balanced refrigeration systems to accomplish operating temperature of 34 degrees F in cooler and -10 degrees F in freezer. BTU calculations are to be based on heavy usage, an ambient temperature of 110 degrees F, 16 hours a day run time in coolers and 18 hours a day run time in freezers.

D. Close the exposed exterior of the walk-in unit adjacent to walls and ceiling with panels of same material as used for exterior of walk-in unit panels and seal in accordance with this Section.

E. Provide door stops where necessary, to prevent walk-in refrigerator and freezer doors from striking adjacent walls, plumbing fixtures or foodservice equipment when door is open.

F. Equip the exterior sides of refrigerator that are not installed against each other or against a wall with a protective covering of 1/8” Aluminum Diamond Treadplate unless otherwise specified in Part 4 of this Section.

G. Wherever compartment dimension exceeds the clear-span ability of ceiling panels, provide I-beam supports on the exterior of the ceiling or supported by spline-hangers.

H. When required, install 1/2-inch diameter steel rods through beam/hangers and secure to the structure above. Beams or posts within compartments are not acceptable.

I. Installer of both insulated panels and refrigeration to be Factory Approved and have written documentation of said Approval. Name of Installer with documentation shall be submitted to Owner for Final Approval.

J. Refer to Part 4 of this Section for detailed walk-in specification.

2.4 EXHAUST HOOD AND VENTILATION SYSTEM STANDARDS

A. Construction of canopy exhaust hood shall be type 304 stainless steel with a #4 polish where exposed.

1. Individual component construction shall be determined by the manufacturer and ETL.
2. Construction shall be dependent on the structural application to minimize distortion and other defects.
3. All seams, joints and penetrations of the hood enclosure to the lower outermost perimeter that directs and captures grease-laden vapor and exhaust gases shall have a liquid-tight continuous external weld in accordance with NFPA 96.
4. Hood shall be wall type with a minimum of four connections for hanger rods. Corner hanging angles shall have a 5/8" x 1-1/2" slot pre-punched at the factory, allowing hanging rods to be used for quick and safe installation.

B. The hood manufacturer shall supply complete computer-generated submittal drawings including hood section view(s) and hood plan view(s). These drawings must be available to the engineer, architect, and owner for their use in construction, operation, and maintenance.

C. Exhaust duct collar shall be 4" high with 1" flange. Duct sizes, CFM and static pressure requirements shall be as shown on drawings. Static pressure requirements shall be precise and accurate; air velocity and volume information shall be accurate within 1-ft increments along the length of the ventilator.

D. U.L. incandescent light fixtures and globes shall be installed and pre-wired to a junction box. The light fixtures shall be installed with a maximum of 4'0" spacing on center and allow up to a 100-watt standard light bulb.

E. A Type 1 grease hoods shall have:

1. A double wall insulated front to eliminate condensation and increase rigidity. The insulation shall have a flexural modulus of 475 EI, meet UL 181 requirements and be in accordance with NFPA 90A and 90B.
2. An integral front baffle to direct grease laden vapors toward the exhaust filter bank.
3. A built-in wiring chase provided for outlets and electrical controls on the hood face and shall not penetrate the capture area or require an external chaseway.
4. Removable grease cup for easy cleaning.
5. Standard built in 3" rear standoff to meet NFPA 96 requirements, when installed in a wall application.
6. U.L. classified filters, supplied in size and quantity as required by ventilator.
7. The hood shall be ETL Listed as "Exhaust Hood Without Exhaust Damper", ETL Sanitation Listed and built in accordance with NFPA 96. The hood shall be listed for 450°F cooking surfaces at 150 CFM/ft, 600°F cooking surfaces at 200 CFM/ft, and 700°F cooking surfaces at 250 CFM/ft.
8. Perforated Make-up Air Supply Plenum (PSP)

    a. The Perforated Supply Plenum (PSP) shall provide make-up air through perforated stainless-steel panels and be located closest to the hood.
    b. Perforated diffuser plates shall be included in the design and to provide even air distribution and the plenum shall be insulated to prevent condensation.

9. AC Perforated Supply Plenum (ACPSP), when specified in Part 4 of this Section.

    a. The AC Perforated Supply Plenum (ACPSP) shall provide make-up air through a dual stream perforated stainless steel plenum and be located farthest from the front hood and in conjunction with the Perforated Make-up Air Supply Plenum (PSP).
    b. Perforated diffuser plates shall be included in the design and to provide even air distribution and shall be insulated to prevent condensation.
    c. The make-up air stream and the air-conditioned stream shall not be permitted to mix until leaving the dual plenum.

F. Fire Suppression System

1. The system shall be an automatic fire suppression system using a wet chemical agent for grease related fires.
2. The system shall be capable of suppressing fires in the following areas associated with cooking equipment: ventilating equipment including hoods, ducts, plenums, and filters; fryers; griddles and range tops; upright, natural charcoal, or chain-type broilers; electric, lava rock, mesquite or gas-radiant char-broilers.

3. The system shall be the pre-engineered type having minimum and maximum guidelines established by the manufacturer and listed by Underwriters Laboratories, Inc. (UL).
4. The system shall be installed and serviced by personnel trained by the manufacturer.
5. The system shall be capable of protecting cooking appliances by utilizing either dedicated appliance protection and/or overlapping appliance protection.
6. The fire suppression system manufacturer shall be ISO 9001 registered.
7. The wet agent shall be a specially formulated, aqueous solution of organic salts with a pH range between 7.7 – 8.7, designed for flame knockdown and foam securement of grease-related fires.
8. The fire suppression system shall be capable of operating in a temperature range of 32 °F to 130 °F (0 °C to 54 °C)
9. The agent tank shall be installed in a stainless-steel enclosure or wall bracket. The tank shall be constructed of stainless steel and shall be provided in one of two sizes: 1.5 gallon (5.7 L) and 3.0 gallon (11.4 L). The tanks shall have a working pressure of 110 psi (7.6 bar), a test pressure of 330 psi (22.8 bar), and a minimum burst pressure of 600 psi (41.4 bar). The tank shall include an adaptor/tube assembly containing a burst disc union.
10. Regulated Release Mechanism: The regulated release mechanism shall be a spring-loaded, mechanical/pneumatic type capable of providing the expellant gas supply to one or two agent tanks depending on the capacity of the gas cartridge used. It shall contain a factory installed regulator deadset at 110 psi (7.6 bar) with an external relief of approximately180 psi (12.4 bar).
11. It shall have the following actuation capabilities: automatic actuation by a fusible link detection system and remote manual actuation by a mechanical pull station.
12. The regulated release mechanism shall contain a release assembly, regulator, expellant gas hose, and agent storage tank housed in a stainless-steel enclosure with cover. The enclosure shall contain knockouts for 1/2 in. conduit. The cover shall contain an opening for a visual status indicator.
13. It shall be compatible with electrical and mechanical gas shut-off devices; or, when equipped with a field or factory-installed switch, it shall be compatible with electric gas line or appliance shutoff devices.
14. When more than two agent tanks are required, the regulated actuator shall be available to provide expellant gas for additional tanks. It shall be connected to the cartridge receiver outlet of the regulated release mechanism providing simultaneous agent discharge.
15. The regulator shall be dead set at 110 psi (7.6 bar) with an external relief of approximately 180 psi (12.4 bar).The regulated actuator assembly shall contain a regulated actuator, regulator, expellant gas hose, and agent tank housed in a stainless steel enclosure with cover. The enclosure shall contain knockouts to permit installation of the expellant gas line.
16. Each discharge nozzle shall be tested and listed with the R-102 system for a specific application.
17. Nozzles tips shall be stamped with the flow number designation (1/2, 1, 2, and 3). Each nozzle shall have a metal or rubber blow-off cap to keep the nozzle tip orifice free of cooking grease build-up.
18. Distribution piping shall be Schedule 40 black iron, chrome-plated, or stainless-steel pipe conforming to ASTM A120, A53, or A106.
19. The detectors shall be the fusible link style designed to separate at a specific temperature.
20. The cartridge shall be a sealed steel pressure vessel containing either carbon dioxide or nitrogen gas. The cartridge seal shall be designed to be punctured by the releasing

device supplying the required pressure to expel wet chemical agent from the storage tank.

21. All fire system detection conduits must be half inch EMT. All conduit fittings must be compression type and fully tightened. All conduit ends must be reamed and deburred and blown clear of debris prior to assembly. All conduits must be fully and robustly supported to avoid accidental fire system discharge.
22. The Fire Suppression System shall include a remote pull station for manual system actuation. The pull station shall be designed to include a built-in guard to protect the pull handle. The pull station shall also be designed with a pull handle to allow for three finger operation and shall be red in color for quick visibility.

    a. Coordinate the location of the fire suppression manual pull stations with Owner and install accordingly and in compliance with National, State and Local codes.

G. Electrical System Controls

1. The Electrical System Controls shall include an LCD based user interface, Demand Control Ventilation (DCV) module, lighting control, duct temperature sensor with automatic fan activation, and built-in gas valve reset relay.

    a. The LCD based user interface shall include real-time status of fans, lights and electric gas valve, audible alerts of failures or issues, alarm notifications displayed in English text, and a display of overload status for fan zone.
    b. If the exhaust duct sensor detects a temperature rise of a fixed differential over kitchen space temperature, the fans shall automatically turn on (meeting IMC Code 507.1.1) and the DCV module shall automatically modulates fans based on cooking load.
    c. Hood alarm system shall be connected to building fire alarm.

H. Ductwork.

1. Ductwork shall be provided and installed by the General Contractor according to all National, State and Local codes.
2. Refer to Division 23 for Ductwork specification.

I. Exhaust fans.

1. Exhaust fan(s) shall be properly sized to evacuate and discharge grease laden vapors, fumes and other contaminants vertically away from the building.
2. All models shall be ETL Listed and comply with UL705 (electrical) Standards and CSA Std C22.2, No 113. Models 12 thru 85 are ETL Listed and comply with UL762 and ULC-S645 Standards. Fan shall bear the AMCA certified ratings seal for sound and air performance.
3. The fan windband shall be constructed of heavy gauge aluminum or G90 Galvanized and shall be spun on an automatic lathe to provide consistent dimensions. Horizontal and vertical internal supports shall be used to securely fasten the windband to the discharge apron to provide rigidity for hinging and added strength to reduce shipping damage. The discharge apron shall have a rolled bead for added strength.

4. The base shall be constructed of galvanized steel for improved rigidity. Base corners shall be welded to provide strength and support for hinging and cleaning and to prevent leakage into the building.
5. The fan wheel shall be centrifugal backward inclined and non-overloading. Wheels shall be balanced in two planes and done in accordance with AMCA standard 204-96, Balance Quality and Vibration Levels for Fans. The wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency, and reduce noise. The wheel blades shall be welded to the wheel inlet cone. If balancing weights are required, they shall be riveted to the blades or wheel. The wheel inlet shall overlap the fan base inlet for maximum performance and efficiency. The wheel shall be firmly attached to the motor shaft with set screws.
6. Standard 115-volt, open drip motors shall be permanently lubricated, rated for continuous duty and thermally protected. Motors shall be mounted out of the airstream and furnished at the specified voltage, phase and enclosure. Motor mounting plate shall be constructed of heavy gauge galvanized steel. The motor compartment shall be cooled by outside air drawn through an extruded aluminum conduit tube. To seal the conduit tube passage and prevent noise silicone rubber grommets shall isolate the conduit tube from the fan housing. The motor compartment shall be of a two-piece construction with the cap having quick release clips to provide quick and easy access to the motor compartment.
7. A grease spout made of aluminum tubing shall be welded to the fan housing. The weld shall be factory tested to ensure it will not leak.
8. To provide a tight seal all fasteners in the fan housing shall be backed with nylon washers.

J. Make-up Air Fans

1. Make-up air fan(s) shall be designed to deliver fresh outside make up air for installations requiring frequent air changes.
2. All models shall be listed by ETL and conforms to UL705 and CSA Std. C22.2, No. 113 standards.
3. The fan shall be constructed of heavy gauge G90 galvanized steel for maximum corrosion resistance. Doors are removable for easy access to interior components for service. Intake hood shall be designed with a large intake area to assure low pressure drop and maximum weather resistance. Weather hood shall include 2" washable filters and inlet screen to prevent large debris from clogging filters.
4. The base shall be constructed of galvanized steel for improved rigidity. Base shall be structurally reinforced to accommodate the blower assembly.
5. Wheels shall be balanced in two planes and done in accordance with AMCA standard 204-96, Balance Quality and Vibration Levels for Fans. The wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency, and reduce noise. The wheel blades shall be securely attached to the wheel inlet ring. The wheel shall be firmly attached to the fan shaft with set screws and keys. The blower assembly shall be isolated from the fan structure with vibration isolators.
6. The blower wheel shall be forward curved centrifugal, constructed G90 galvanized steel.
7. Direct drive blower assembly shall consist of a centrifugal backward inclined, non-overloading wheel secured directly to a heavy duty, ball bearing type motor via two set screws. The motor and wheel assembly shall be mounted to a heavy gauge galvanized steel frame. The motor shall be controlled by a variable frequency drive, allowing for variable airflow without the need of belts and pulleys.

8. Motors shall be heavy duty ball bearing type and furnished at the specified voltage, phase, and enclosure. Motor mounting plate shall be constructed of heavy gauge galvanized steel and shall be designed to provide easy adjustment of belt tension (belt drive units only).
9. Shafts shall be precision ground and polished. Heavy duty, pre-lubricated bearings shall be selected for a minimum life in excess of 200,000 hours of operation at maximum cataloged operating speed. They shall be designed for, and individually tested specifically for use in air handling applications.
10. Belts shall be oil and heat resistant, non-static type. Drives shall be cast type, precision machined and keyed and secured attached to the fan and motor shafts. Drives shall be sized for a minimum of 150% of the installed motor horsepower. Fan operating speed shall be factory set using adjustable pitch motor pulleys; motors over 3 HP will come standard with double groove pulleys.
11. Modular packaged heating, cooling, and ventilating unit(s), as indicated on the drawings shall be furnished.
12. If a Direct Fired Gas Unit(s) is specified it shall be tested in accordance with ANSI Standard Z83.4a-2001/CSA 3.7a-2001 and shall bear the ETL label. Orientation shall be horizontal, down or side discharge. Unit(s) shall be factory assembled, tested, and shipped as a complete packaged assembly, for outdoor mounting, consisting of the following:

    a. Gas burner

        (1) The gas burner shall be direct-fired, draw-through type, sized to provide an appropriate BTUH output using natural or propane gas at an inlet-supply minimum pressure of 7" water column.
        (2) The burner shall be capable of heating the entire air supply to the appropriate operating temperature. The burner shall burn over its entire length at all times when the system is in operation.
        (3) The burner shall have non-clogging, 4302B stainless-steel combustion baffles attached to a ductile aluminum gas-supply section with no moving parts to wear out or fail. The burner shall be capable of 92% combustion efficiency with a maximum turndown ratio of up to 30 to 1.
        (4) The gas burner shall be furnished with a pilot package arranged so that the pilot flame lights the burner with instantaneous ignition. Pilot assembly includes a flame rod, spark rod and pilot, which is automatically ignited by ignition transformer. A flame-rod rectification system shall be used to prove pilot and main flame.
        (5) Rear access doors will provide complete access to burner and pilot assembly.
        (6) Burner profile plates shall be self-adjusting to operate across the complete CFM range of each model heater.
        (7) Components shall include pilot-gas shut-off valve, pilot-gas regulator, pilot-gas valve, main-gas shut-off valve, main-gas regulator, two solenoid valves, modulating-gas valve and burner.
        (8) Furnish a gas pressure regulator on gas equipment if required.
        (9) Furnish with high and low gas pressure switches to open circuit to electronic flame-safety relay.

    b. Centrifugal blower (forward-curved double width/double inlet or backward inclined)

c. Motor starter with thermal overload protection
d. Motor and drive assembly
e. Fuel burning and safety equipment
f. Temperature control system
g. Gas piping
h. Pre-piped and charged condenser(s)

K. Hoods and fans are to be provided by the Foodservice Equipment Contractor. All ductwork, duct collars, hanging rods and all accessories necessary to complete hood installation, not provided by the Foodservice Equipment Contractor, are to be provided and installed by the GC.

L. Wall types, finishes and flashings beneath the hood.

1. Wall types and finishes beneath the exhaust hood shall comply with IBC 507.2.6 and be a non-combustible material a minimum of 18" beyond the hood in all directions and shall be smooth, cleanable and nonabsorbent.
2. Where stainless steel wall flashing is used beneath the exhaust hood it shall be type 304 with a #4 finish.
3. See foodservice elevations for additional details.

M. See Hood Detail Sheets in Foodservice Set for detailed specification information.

2.5 UTILITY DISTRIBUTION SYSTEM STANDARDS

A. A Utility Distribution System shall be provided be as indicated on drawings. Systems shall have two vertical risers, one on each end, with one dedicated to electrical and the other to plumbing. The horizontal distribution raceway between the risers shall be separated into electrical and plumbing compartments and each shall be completely enclosed and watertight with removable access panels. The risers and raceway shall be constructed of 16-gauge, type 304 stainless steel, #4 finish. A circuit protected dual convenience outlet shall be provided on each riser. Service connections shall be located behind easily removable access panels.

B. Electrical Riser: Main power connection shall be made to the main circuit breaker which has a shunt trip and is mounted in the electrical riser.

C. Electrical Riser and Wireway Systems

1. Electrical power shall be fed through a main circuit breaker to a distribution panel which contains individual branch breakers.
2. Each appliance shall be fed from the individual breakers which are wired to each receptacle located along the raceway.
3. The main circuit breaker shall be equipped with a built-in 120 VAC rated shunt trip and shall be located in the electrical riser requiring a single point incoming connection.
4. Terminal block connections shall be provided for field interconnection between the shunt trip and the fire protection system for power shut-off in the event of a fire.
5. All outlets shall be equipped with grounding type receptacles having specific NEMA polarized configurations and located on the underside or front side of the raceway at each equipment location. Outlets shall be matched to the cord and plug sets supplied

with equipment. Twist lock cord and plug sets are provided for equipment supplied without cords.

6. All 120V, single phase 15 and 20 AMP receptacles shall be DCO-GFI.

D. Plumbing Riser

1. The plumbing compartment shall be completely isolated from the electrical with all piping labeled.
2. The plumbing riser shall house manual (quarter-turn) shut-off valves for each incoming main supply line located in the UDS.
3. The plumbing manifolds shall be provided with stub-outs along the raceway for the individual plumbing connections and color coded hoses and located at each equipment location.
4. Each stub-out shall be equipped with a manual (quarter-turn) shut-off valve.

E. Gas and Steam Piping

1. Gas and steam piping, including branch connections, shall be threaded black iron.
2. There shall be a drip tee on the incoming gas end.
3. The gas manifold shall be furnished with either an electrical or mechanical gas valve which shall be field interlocked with the fire protection system to shut off fuel sources in the event of a fire.
4. Electrical gas valves shall be furnished with a manual gas reset button and time delay relay to prevent pilot lights from going out in momentary power outages, located in the UDS riser.
5. Gas manifolds shall be sized for an inlet pressure of 7" WC for natural gas or 11" WC for LP.
6. Gas quick disconnect hoses, cable restraints and posi-set caster placement systems shall be provided separately with equipment as specified in Part 4 of this Section.

F. Expandability: All electrical systems are designed for additional capacity for future expansion or upgrade of connected appliances.

G. Wireway: Electrical distribution panel located in the riser shall be equipped with branch circuit breakers and sized for expansion.

H. Serviceability and Accessibility: Lift-out doors shall provide easy access to risers without moving cooking equipment, in most cases. Removable panels provided along the length of the raceway shall allow access to either plumbing or electrical compartments.

I. When water filtration is required, provide a hat channel mounted to exterior of UDS raceway for mounting individual water filters as located on the Foodservice plans.

J. Electric Outlets and Cord Sets: All outlets shall provide moisture resistant covers and have been sized per NEMA standards. Each is supplied with a matching cord and plug set if these are not already supplied by the equipment manufacturer. Twist-lock sets are standard in island applications. All 120V, single phase 15 and 20 amp receptacles are DCO-GFI.

K. Main Disconnect: One point disconnect through a main circuit breaker equipped with a 120 VAC rated shunt trip provided in the riser. A shunt trip shall be provided with each main breaker.

L. Gas Solenoid Valve: Electrical or Mechanical. Electrical valves shall be provided with a manual reset button and time delay relay to prevent pilot lights from going out in momentary power outages.

M. Appliance Protection: Each electrical outlet connection shall be protected with an individual circuit breaker.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION PROCEDURE

A. Prior to commencement of installation, perform a complete walk down of the facility with the General Contractor to verify readiness for installation.

B. All sizes given are approximate and are as accurate as can be determined at this time. Verify all measurements at the building prior to fabrication of equipment. All equipment must conform to the finished building conditions. Where obstructions occur, equipment must be neatly scribed, fitted to and around the same, resulting in a sanitary, homogenous fixture.

C. Coordinate with other contractors for provision and scheduling of temporary openings in walls or floors which may be required for passing large sections of equipment into the building that cannot be accommodated through permanent openings.

3.2 CHANGES IN WORK

A. The drawings indicate the desired basic arrangement and dimensions of the equipment. Reasonable modifications in the routing of work and relocation of equipment may occur. This specifically refers to conditions where interference occurs or where more desirable accessibility can be obtained or where material cannot be installed because of structural or mechanical conditions encountered.

1. Minor deviations therefore may be substituted for approval provided basic requirements are met and no major rearrangement of service to the equipment is required to affect the proposed alteration.
2. Such deviations shall be made without expense to the Owner.

B. Conflict in plans and specifications where changes, alteration or deductions are necessary, or where exceptions are taken regarding sizes, locations and other details shown on plans shall be reported to the Architect in writing for his interpretation and answer in writing.

1. Such work will be at no additional expense to the Owner.

3.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. General contractor shall provide secured, on-site storage for all new and existing foodservice equipment and foodservice related items that are provided by the Owner and/or their contractor.

B. Deliver field assembled fixed equipment integrated into structure to jobsite when required.

C. Deliver fixed equipment not integrated into structure to the jobsite after completion of finished ceilings, lighting, and acidizing of the finished floor and wall systems, including painting.

D. Set all equipment plumb and level. Except for mobile and adjustable-leg equipment, securely anchor and attach items and accessories to walls, floors, or bases with stainless steel bolts.

E. Deliver major movable equipment to inventory in a secured area for interim jobsite storage, or if secured area is not available, when fixed equipment installation/clean-up has been completed.

F. Deliver minor appliances and loose items to the jobsite when the General Contractor is prepared to receive and inventory such items.

G. Provide adequate protection of all finished surfaces, fixtures, furnishings, and other equipment to prevent any damage during the installation work. Clean, polish or repair any damaged surfaces prior to the final inspection.

H. Store delivered items with protection from weather, humidity, and temperature variation, dirt and dust, or other contaminants. Clearly label and identify all components with respective number as enumerated in approved Foodservice Equipment Schedule.

I. Do not use foodservice equipment as tool or material storage, work bench, scaffold, or stacking area.

J. Immediately submit documentation of damaged equipment to the General Contractor with a recommendation of action for repair or replacement and the impact on project schedule.

K. Conduct installation procedures conforming to applicable NSF, OSHA (if required) and UL standards specified, and the manufacturer's instructions.

3.4 TRIMMING AND SEALING

A. All equipment that rests on concrete masonry bases shall be set, leveled, and sealed as required by Health Department Codes.

B. All equipment butting walls shall be scribed and sealed to the walls with a silicone rubber sealant. Where there is any vertical or horizontal gap larger than 1/8 inch it shall be trimmed with 20 gauge finished stainless steel closures at no extra cost.

C. Seal around equipment flashing and flanges, at walls, floor, and ceiling

D. Fillers must be continuous, without opening.

E. Where two or more pieces of equipment or separate parts of a single piece of equipment join, the seam shall be sealed with a silicone rubber sealant.

F. Hi-Temp silicone sealant, or equal to be used at joints between pieces of heat producing equipment.

G. Ends of all back splashes and hollow sections shall be closed during fabrication.

H. No drilling, cutting, burning, or welding of structural parts of building is permitted. Provide access panels for concealed valves, vent controls, and control devices and items requiring periodic operation, inspection, or maintenance.

3.5 INSTALLATION

A. Gas Equipment

1. Installation of gas operated equipment must conform to NFPA 54.
2. Gas burning equipment shall be designed for operation with the type of gas furnished and shall be approved by the American Gas Association. The label or listing of the American Gas Association will be accepted as conforming with this requirement. Installation of equipment shall conform to the standards as set forth by the American Gas Association, and the National Plumbing Code. All gas equipment shall be furnished with safety pilot and one hundred percent (100%) safety cut-off, as required.
3. Mobile equipment must be provided with a minimum 48-inch-long quick gas disconnect with swivel connectors at each end of hose and floor mounted posi-set brackets. Fasten a heavy-duty steel cable, shorter than the equipment connector, to the equipment and the walls.
4. When not provided with equipment the Plumber shall provide gas pressure regulators where required and all additional parts and accessories to make equipment operational.

B. Plumbing Work

1. Furnish and install chrome plated faucets specified herein for sinks, kettles, etc. All backsplash mounted faucets shall be furnished with double male nipples having locknuts for rigidly securing the faucet to the backsplash, this nipple-locknut assembly shall be furnished and installed under this section, as part of the faucet.
2. Locate water inlets above the positive water level to prevent siphoning of liquids into the water system. Wherever conditions shall require submerged inlet, suitable type check valve and vacuum breaker shall be placed on the fixture to form part of same to prevent siphoning.
3. Provide extensions of indirect waste from foodservice equipment fitting to open-sight hub drain, floor sink, floor drain or floor trough as shown on the foodservice plumbing plans.
4. Provide ArmaFlex insulation (or equivalent) on horizontal run of ice maker and ice bin drain to floor sink/trough.
5. The Kitchen Equipment Supplier shall provide suitable pipe slots and/or do all drillings, punching, and cutting of his equipment required to provide access for mechanical connections and/or runs. Such work when performed at the job site shall be of the same quality as similar work performed in the shop.
6. To ensure proper clearance for cleaning, horizontal piping lines shall run at the highest possible elevation and not less than six inches above the floor, through equipment wherever possible.
7. No exposed piping about fixtures or in other conspicuous places shall show tool marks or more than one thread at the fitting.

8. When not provided with equipment the Plumber shall provide pressure regulators where required (when water pressure exceeds manufacturer recommended PSI range), P-traps, supply lines and all additional parts and accessories to make equipment operational.

C. Backflow Preventers

1. Furnish and install backflow preventers as specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE. The Kitchen Equipment Supplier is responsible to install backflow preventers as shown on the contract drawings and at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any source of non-potable water, or other contaminant. Install backflow preventers at all locations where the potable water outlet is below the flood level of the equipment or will be located below the level of the contaminant. Provide backflow preventers of sufficient size to allow unrestricted flow of water to the equipment and preclude the backflow of waste or other contamination into the potable water system.

D. Electrical Work

1. Electrical systems, components and accessories must be certified to be in accordance with NFPA 70
2. The Kitchen Equipment Supplier shall provide adequate raceways and accesses in fixtures for this work. Where the Kitchen Equipment Supplier fails to provide for such space, he shall correct his work without expense to the Owner. Cutting and patching required by such work shall be reworked to its original finish.
3. The Kitchen Equipment Supplier shall verify with Mechanical and Electrical plans for electrical voltages, cycles, phases, and special requirements before ordering equipment.
4. The Kitchen Equipment Supplier shall coordinate his work with the Electrical Contractor so that the receptacles provided will match the specific plugs installed as part of the plug-in equipment.

    a. Any changes in cords and plugs required in the field due to lack of coordination between the Electrical and Foodservice Equipment Contractors shall not be at any additional expense to Owner.
    b. Foodservice Equipment length of cords furnished with the specified equipment to be a suitable or appropriate length, so they do not interfere with other equipment.

5. Coordinate all foodservice equipment cord/caps with related receptacles. All 120/208/240 volt "plug-in" equipment must have Type SO or SJO cord and a plug with ground, fastened to frame/body of item.
6. Mobile electrical support equipment (heated cabinets, dish carts, etc.) and counter appliances mounted on mobile stands (mixers, food cutter, toaster, coffee makers, microwave ovens, etc.) must have cord/cap assembly with cord-hanger as provided by the manufacturer.
7. When not provided with equipment the Electrician shall provide all necessary parts and accessories to make equipment operational.

E. Installed Electrical Load

1. If the electrical load of the approved equipment differs from that specified or shown on the drawings, coordinate with the General Contractor to provide and install electrical service compatible with the approved equipment at no additional cost to Owner.

F. Steam Connection Provisions

1. Provide all steam-injected equipment with a steam inlet globe control valve with cold handle, relief valve, strainer, condensate gate valve, bucket steam trap, pressure regulators, swing check valve and other devices required for the proper operations of steam operated equipment.
2. Interconnect devices and make ready for final connection.
3. Compartment steam cookers must have piping manifolded from all compartment exhaust valves to a floor drain, floor sink, or drain trench that can withstand drain water temps of up to 160 degrees.
4. Provide steam generators specified within this section with automatic boiler blowdown and a cold-water condenser, unless otherwise specified in Part 4 of this Section.
5. Separate equipment, devices or components indicated to be connected to a steam-generator, provided under this section, must be provided with all unions, ells, gate valves, nipples, brackets, clamps, etc., required for the complete operating system for final connection.
6. Steam supply piping must be insulated with 1 inch fiberglass insulation and have factory-applied fire retardant.
7. Install a full-length 16-gauge stainless steel pipe enclosure with sloping top, jacket, and vapor barrier over steam lines.
8. All safety devices required to comply with the aforementioned regulations shall be furnished, regardless of whether or not specified or called for in the following technical divisions of the equipment list schedule.

G. Remote Refrigeration Equipment

1. Refrigeration systems for both walk-in freezer and cooler shall be fully self-contained remote system pre-wired and pre-charged at the factory. Both systems shall be fully tested at the factory. No field installation other than final electrical hook-up, control wiring, and quick disconnect assembly shall be required.
2. Refrigerant lines shall be type "L" hard copper with brazed joints. with forged or wrought copper fittings. Silver solder and/or Sil-Fos shall be used to join all refrigerant piping. Soft solder is not acceptable.
3. All refrigerant lines shall be extended in a neat and orderly manner and shall be coordinated with General Contractor.
4. All refrigeration piping shall be properly supported by adjustable hangers spaced and adjusted to the drop required.
5. Refrigeration line runs from remote condensing units to evaporator coils shall have long sweep elbows at all ninety degree turns and shall not exceed 100 ft (includes horizontal and vertical runs).
6. A full charge of appropriate refrigerant and oil for each system per the manufacturer specifications.
7. Hard copper line sets are to be installed in accordance with acceptable refrigeration practices including utilization of all necessary line traps and line grading to maximize the flow of oil and refrigerant throughout the system.

8. Trap refrigerant lines prior to the evaporator coil when the vertical rise is over 10'. Where refrigerant suction lines are trapped, use next size smaller pipe in vertical portion of the trap than that indicated to acquire sufficient gas velocity for proper air return.
9. All refrigerant lines shall be insulated their full length with anti-sweat pipe covering of 3/4-inch Armaflex or equal. Provide an aluminum jacket around all insulated refrigerant lines exposed to the weather.
10. If refrigerant lines are in air return plenum areas, insulation as required by local code shall be used.
11. Metal pipe sleeves shall be provided by the General Contractor where piping passes through a wall, ceiling, or floor.
12. All walk-in panel penetrations and all copper lines run through exterior walls shall be field drilled with PVC sleeves utilized. Sleeves shall be internally sealed with polyurethane foam. All sleeves shall be furnished as part of installation.
13. Provide a minimum 1/2-inch copper drain tubing from drain pans below coils to drains, furnished and installed by system installer. Drains shall be trapped outside of walk-in and run to sanitary drain. Cooler and freezer drains shall be insulated with 1" thick mold resistant ArmaFlex SS self-seal insulation (or equivalent). Freezer drain shall be wrapped in electrically heated heat tape and insulated to prevent freezing. All plumbing to be in accordance with applicable codes. See typical evaporator coil drain line detail 1P on the General Notes and Detail sheet in the Foodservice set.
14. ALL penetrations of walk-in panels shall be sealed with silicone caulk and finished with a metal plate.
15. Electrical Contractor shall provide and install the main power to each disconnect and shall also interwire power from the defrost time clock to the electric defrost evaporator coil(s).
16. Control and thermostat wiring and all necessary components not provided by the Kitchen Equipment Supplier and required to make the refrigeration system function properly shall be included as part on electrical contract.
17. BAS wiring for temperature monitoring and control shall be required. See Section applicable to Building Automation Systems for additional information.
18. The Foodservice Equipment Contractor will be required to coordinate with other trades in their work of connection. Units shall comply in all respects to design drawings and any discrepancies noted during the bidding process shall be immediately noted to the Consultant for interpretation and action. No extras will be considered after the bidding process for not following the above procedures.
19. Cooler to operate at +34 degrees Fahrenheit and Freezer to operate at –10 degrees Fahrenheit. Walk-ins are to be running and adjusted a minimum of 24 hours prior to the loading of product. Freezers are to be cooled down in stages over a 12 hour period to –10 º F.

H. Owner Provided Equipment

1. Delivery of Owner furnished equipment for installation by General Contractor shall take place at a time to be determined by the Owner.

I. Existing Equipment to be Reused

1. All existing equipment to be reused shall be carefully removed by the Foodservice Equipment Contractor, cleaned, refurbished or repaired (if necessary), transported to and

stored in a clean, safe and dry environment until such time that the equipment is to be reinstalled.

2. Existing and reused equipment shall be installed according to the manufacturers' original installation recommendations and shall be made completely operational, tested to determine correct operational status (i.e., lights working, refrigeration and heated holding components holding proper temperature, drains clear and working, water supply working, electrical components working). This shall be the responsibility of the Kitchen Equipment Supplier and he shall provide all necessary parts and labor to cause reused equipment to fully operate correctly.

J. Field Assembled Equipment

1. Field-assembled equipment (example, prefabricated cold storage assemblies, conveyor systems, exhaust hoods) must have electrical components completely interconnected by this section for final connection as indicated on utility connection drawing. Prewire the following groups of cold storage assembly electrical devices to a top-mounted junction box for final connection per compartment grouping, unless otherwise indicated.

3.6 FIELD REPRESENTITIVE

A. The Kitchen Equipment Supplier shall provide a competent field representative to be present during installation. The representative shall be well informed as to all phases of the work and shall instruct the respective trades on connection details so as to achieve the best possible installation.

3.7 START-UP, TESTING, TRAINING AND REGULATIONS

A. A qualified representative of the Kitchen Equipment Supplier shall supervise the start-up and testing of the equipment, instruct and train the kitchen staff in the operation of the equipment, and perform such tests as required by Owner to demonstrate that the equipment complies with the specifications.

B. The representative shall perform tests in the presence of the Owner/Owner's representative and/or the General Contractor.

C. The Kitchen Equipment Supplier shall provide one (1) hour minimum training performed by an authorized Chef representative for each piece of equipment installed. Training shall be scheduled with Owner within three (3) business days of school opening.

D. Start up and operate all equipment.

1. Coordinate start-up of equipment with testing and balancing of HVAC system. Ensure that HVAC will be operating properly even during maximum equipment use.
2. Start-up shall be scheduled no less than ten (10) business days prior to Owner training to allow resolution of any service issues discovered during start up.
3. At the start of operation, devote one full working day monitoring all equipment operation. The purpose of this day is to ensure equipment is in proper working order at start.
4. Provide all lubricants, chemicals, cleaning agent and accessories before initial start-up.

5. Follow the manufacturer's procedures and place the systems under all modes of operation.
6. Provide all materials, accessories, cleaning solutions and any items necessary for the proper operation of equipment at time of start-up.
7. Provide Architect with an affidavit signed by Owners and Operator that this service was rendered and performed.

E. Remote Refrigeration.

1. All refrigerant piping to be pressure tested with nitrogen at 300 psi. After the condensing units and coils have been connected, the balance of the system shall be leak tested with all valves open. The complete system shall be evacuated with a vacuum pump. Charge, test, and adjust each unit to make it operational in accordance with acceptable refrigeration practices.
2. Operational and functional test of the installed remote refrigeration equipment is required. Equipment shall operate continuously for a minimum of 7 days prior to date of Substantial Completion.
3. The Kitchen Equipment Supplier and Manufacturer's Representative shall instruct Owner personnel regarding operation, lubrication, and maintenance of refrigeration units.

F. Foodservice Exhaust Hood Ventilation System

1. Perform a test and balance, as well as the simple performance test in accordance with International Mechanical Code Section 507.16.1. This must be coordinated with the Mechanical contractor.
2. A test of the hood fire suppression system shall be performed by a factory authorized, trained service technician. Documentation of compliance shall be provided to the Owner.
3. Gas-fired make-up air fans shall be operated, tested and set at the factory using job-site conditions for electrical and gas input. All operating and safety controls shall be tested and set at the factory. Adjustable or fixed sheaves shall be set for proper RPM at specified conditions. Gas-pressure regulator shall be set for specified burning rate at specified inlet pressure.

G. Utility Distribution System

1. Unit(s) shall be operated, tested and set at the factory using job-site conditions for electrical and gas input. All operating and safety controls shall be tested and set at the factory. The Kitchen Equipment Supplier shall furnish gas piping schematics, as built wiring connection and control-circuit diagrams, dimension sheets and a full description of the unit(s).
2. Service manuals showing service and maintenance requirements, shall be provided with each unit.

H. Contractor shall turn over all door padlocks and keys to Owner’s Facility Services Project Manager as part of close-out procedures. Padlock shall be keyed to the school system.

I. Supplement initial charges of lubricating oil to assure maximum operating capacity. Adjust all safety and automatic control instruments.

J. Defects or deficiencies noted by tests shall be corrected to the entire satisfaction of the Architect or Owner at no additional expense to the Owner. KES shall consult the mechanical and electrical connections drawings and their accompanying specifications to determine additional requirements of the work and shall cooperate with all trades to insure a completely satisfactory installation.

K. Secure inspection approvals from governing code officials and health inspector.

3.8 CLEANING

A. At all times, keep the premises free from accumulations of waste materials and rubbish caused by the work.

B. Wrapping and protective coverings shall remain on all items until installation is complete and job is ready for cleaning.

C. Clean all equipment items provided under this contract prior to inspection and acceptance of the work.

D. Separate waste in accordance with the General Contractor's waste management plan for trash and recyclables.

E. Close and seal tightly all partly used adhesives and solvents; store protected in a well-ventilated, fire-safe area at moderate temperature.

3.9 WARRANTY AND SERVICE

A. All material as specified shall be new, of the best quality, perfect, and without flaw. Equipment shall be delivered in an undamaged condition upon completion. All workmanship and labor shall be of the best in their respective fields and skilled mechanics of the trades involved.

B. Warranty all work provided under this Section against defects in workmanship and materials for one (1) year from the date of final acceptance of the completed installation, unless otherwise specified.

C. The Kitchen Equipment Supplier shall provide one electronic copy (in PDF format) and two hard copies of all warranty information and certificates of all foodservice equipment installed.

D. The Kitchen Equipment Supplier shall, for a period of one year, provide the owner with warranty service during business hours (8:30am-5:00pm) for all foodservice equipment installed. He shall dispatch service calls to the appropriate manufacturer's authorized service agents and ensure service is performed and completed within 24 hours. He shall maintain logs and records of all service calls, completion dates, serial numbers, parts replacement and any other service-related information.

E. If, within any warranty period, repairs or changes are required in connection with warranted work, the Kitchen Equipment Supplier shall correct all defects therein and make good all damage to the building, equipment, and/or contents thereof which is the result of the use of

materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the contract.

1. All non-conforming or defective products shall either be replaced at no cost to the Owner within thirty (30) days of request or the Owner shall be provided with a full refund for the purchase price of the defective good.
2. Any replacement item must be of the same or comparable make and model.

F. In addition, all compressors supplied for refrigeration units either remote, connected, or as an internal part, shall be supplied with the manufacturer's five (5) year extended warranty.

G. Walk-in shall be provided with the following warranties:

1. Ten (10) years non-prorated material against material defects in panel system, panel & door insulating value.
2. One (1) year parts and labor on entire refrigeration system. Provide an additional four (4) year parts and labor warranty on compressor only.
3. Ten (10) years Original Equipment Manufacturer (OEM) material warranty on roofing membrane on outdoor walk-in. Roofing membrane to be free from manufacturing defects at time of delivery and shall not become defective during the warranty period when specifications are met during installation. In the event of a manufacturing defect, OEM shall repair or replace membrane.
4. All refrigerant systems shall be guaranteed free of leaks for 1 year by installer including all parts and labor.
5. All defects found within the above warranty periods shall be promptly remedied at no expense to the Owner. A replaced compressor shall carry a renewed one (1) year material warranty from date of replacement.

H. The pre-engineered exhaust hood fire suppression system components shall be warranted for five (5) years from date of delivery against defects in workmanship and material.

PART 4 - FOODSERVICE EQUIPMENT

ITEM 001 - 72" AIR CURTAIN FAN (1 REQ'D)
Berner Model CHD10-2072A
Commercial Series High Performance Air Curtain, 72" long, unheated, (2) 1/2 hp three speed motors, for door height up to 10-feet high, aluminum housing with white finish, indoor mounting only, cULus, MADE IN USA
1 ea Model A 120v/60/1-ph
2 ea Model 9503SD020-P Automatic Door Switch, plunger type, activates air door when door opens, single phase only & max. amp draw of 20 amps, 120-240V
1 ea Stainless steel exterior finish add sufix "SS" to model no. (contact factory for lead time)
1 ea Five year parts warranty (unheated units)

ITEM 002 - S/S WORKTABLE WITH DRAWER (1 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Work Table, size and shape per plan, 35" H with 4-1/2"H backsplash as follows:

1. 14/304 stainless steel top and splash
2. Square edge table
3. All welded construction, legs, undershelf and top
4. 16/304 stainless steel undershelf with marine edge
5. 1-1/2" rear upturn for undershelf
6. (6) stainless steel legs
7. Bullet Feet, stainless steel, NSF
8. Heavy Duty Drawer Assembly, 20" x 20" x 5", 304 type stainless steel, insulated drawer front, removable drawer pan, self-closing drawer slides, stackable, hemmed safety pull handle

NOTE: All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

ITEM 003 - S/S OVERSHELF (1 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Shelf, wall-mounted, 96"W x 12"D x 12-1/2"H, 16/304 stainless steel construction, 1-1/2" lip on sides & rear, 3/4" radius rolled front edge, stainless steel brackets, NSF.

NOTE: All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

ITEM 004 - DRY STORAGE SHELVING (18 REQ'D)
Metro Model -
Dry storage shelving (5 tier) consisting of the following:

50 ea	Model 2460NC Super Erecta® Shelf, wire, 60"W x 24"D, chrome plated finish, plastic split sleeves are included in each carton, NSF
40 ea	Model 2448NC Super Erecta® Shelf, wire, 48"W x 24"D, chrome plated finish, plastic split sleeves are included in each carton, NSF
72 ea	Model 74UP Super Erecta® Post, 73-7/8"H, for use with stem casters, chrome plated finish
72 ea	Model 5MB Super Erecta® Stem Caster, swivel (with foot operated brake), 5" dia., 1-1/4" face, 200 lb. capacity, resilient rubber flat wheel tread, includes bumper

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ITEM 005 - DRY STORAGE DUNNAGE RACKS (5 REQ'D)
Cambro Model -
Dry dunnage racks consisting of the following:

1 ea	Model DRS360480 S-Series Dunnage Rack, slotted top, 1500 lb. load capacity, 21"D x 36"W x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, speckled gray, NSF
4 ea	Model DRS480131 S-Series Dunnage Rack, slotted top, 3000 lb. load capacity, 21"D x 48"W x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, dark brown, NSF

ITEM 006 - CAN RACKS (3 REQ'D)
Channel Manufacturing Model CSR-156M
Can Storage Rack, First In/First Out (FIFO), mobile, 25-1/2"W x 42-1/4"D x 88"H, front loading, holds (156) #10 cans, inclined angle can slides, welded aluminum construction, 5" swivel casters, NSF, Made in USA (published shipping weight does not reflect 50lb. pallet)

ITEM 007-009 - SPARE NO. <Spare No.>

ITEM 010 - WALK-IN COOLER (1 REQ'D)
Bally Refrigerated Boxes Model -

GENERAL SPECIFICATIONS:

The BALLY INDOOR walk-in specified shall be prefabricated modular construction. It shall be designed and constructed to allow fast and easy field assembly, disassembly, relocation and enlargement by the addition of like modular panels. Walk-in shall be designed and constructed as shown on plan. Overall size of walk-in shall be actual dimensions to fit exact job site requirements.

See sheet FS401.1 in the Foodservice plans and Parts 2.3, 3.5(G) and 3.7(E) of this section for additional details.
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COOLER DETAILS:

1. Interior walls shall be white embossed aluminum; Unexposed exterior shall be embossed aluminum.
2. Interior ceiling shall be white embossed aluminum finish; Exterior ceiling shall be embossed aluminum finish.
3. The walk-in door and frame and any exposed exterior around walk-in door shall be 22 gauge smooth stainless steel.
4. Interior floor shall be c-channel reinforced with 1/2" plywood underlay and integral 1/8" thick Aluminum Diamond Treadplate applied at factory.
5. The overall cooler exterior height shall be 9'-6"
-

FREEZER DETAILS:

1. Interior walls shall be white embossed aluminum; Unexposed exterior shall be embossed aluminum.
2. Interior ceiling shall be white embossed aluminum finish; Exterior ceiling shall be embossed aluminum finish.
3. The walk-in door and frame and any exposed exterior around walk-in door shall be 22 gauge smooth stainless steel.
4. Interior floor shall be c-channel reinforced with 1/2" plywood underlay and integral 1/8" thick Aluminum Diamond Treadplate applied at factory.
5. The overall cooler exterior height shall be 9'-6"
-

PANEL CONSTRUCTION:

Wall and ceiling panel widths shall be within 1” increments up to 46” wide. Corner panels shall be 90 degree angle, 12” x 12”. All panels shall be interchangeable with like panels for fast and easy assembly. Partition panel placement shall be within 1” increments to meet shelving space requirements.

All panels shall consist of metal pans formed to precise dimensions. Metal finish to be as specified. Insulation shall be “foamed-in-place” urethane to bond permanently to complete inner surfaces of both interior and exterior metal pans to form strong rigid unit. Panels shall not have internal wood or metal support, framing, straps, or other non-insulating members. Each panel shall be 100% urethane foam insulation exclusive of metal pans. Perimeter structure shall be formed of DURATHANE, high density

urethane insulation forming tongues and grooves to assure vapor and airtight joints and to prevent pre-installation damage and deterioration of exposed urethane surfaces.
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FLOOR CONSTRUCTION:

Walk-in floor shall be reinforced and designed to withstand uniformly distributed stationary loads of 12,000 lbs. per square foot. Interior floor shall be c-channel reinforced with 1/2" plywood underlay and integral 1/8" thick Aluminum Diamond Treadplate applied at factory.

Floor shall be fabricated to be recessed into concrete slab to be level with finished kitchen floor.
-

INSULATION:

Insulation shall be 4” thick rigid, zero ozone depleting HFC 134a blown Class I urethane foam classified according to UL 723 (ASTM-E-84) as tested by Underwriters Laboratories, Inc. The core material has a flame spread of 25 or less and a smoke density of 250.

The urethane foam is foamed-in-place to bond to inner surfaces of metal pans having an average thermal conductivity (K factor) of 0.13 BTU/hr./sq. ft. per degrees /Fahrenheit/inch. As tested in accordance with ASTM C 518-2004, the R factor for both cooler and freezer walls and ceilings shall not be less than 25 and floors not less than R-28 (meet or exceed 2018 International Energy Conservation Code (IECC))

The prefabricated urethane foamed panels shall be supplied with a Class I fire hazard classification according to UL 723 (ASTM-E-84) as tested by Underwriters Laboratories, Inc. Panels shall have a flame spread rating of 25 or less and bear a certifying Underwriters Laboratories, Inc. label.
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PANEL LOCKING ASSEMBLIES:

Assembly of walk-in shall be accomplished by “Insta-Loks” consisting of cam-action hook arm assembly set in one panel and a self-aligning, self-centering, pin assembly set in the matching panel. All vertical joints must have a minimum of three Insta-loks. Rotation of the cam-action hook arm shall pull and lock panels together to form airtight, vapor proof joints. Metal straps shall be used inside the panels for longevity. Rotation of the cam-locks shall be operated from inside the walk-in through access ports that are sealed with vinyl snap-in closures.
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PANEL GASKETS:

NSF listed double-bead vinyl gasket shall be applied to the tongue side of all panels, on both interior and exterior. Gaskets shall be impervious to stains, grease, oils, mildew, sunlight, etc.
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ENTRANCE DOOR AND FRAME:

Walk-in compartment shall be equipped with a 36” x 78” hinged-type, flush-mounted entrance door mounted in a nominal 4’, 5’ or 6’ frame and located in exact location as shown on drawing. Door placement shall be within 1” increments to meet shelving space and job site requirements. Door and frame shall be listed by Underwriters Laboratories and bear the UL Seal of Approval.

Door shall be equipped with a one-piece perimeter PVC accordion type removable gasket with magnetic core at the top and along the side perimeter of the door. An adjustable wiper gasket shall be mounted

along the bottom edge of the door. Provide vinyl strip curtain with each door (compliant with 2018 International Energy Conservation Code).

Latch shall be break-a-way type with cylinder lock and inside safety release handle so the door can be opened from the inside even if locked. A positive action hydraulic door closer (compliant with 2018 International Energy Conservation Code) shall be included to ensure gentle closing action of door to opening and to ensure positive closing of door. The latch shall be of high pressure zinc die cast with highly polished chrome finish.

Hinges shall be three (3) nine inch modified strap, cam-lift, self-closing design with door lift off capability of high-pressure zinc die cast with highly polished chrome finish. (compliant with 2018 International Energy Conservation Code)

Door frame shall consist of heavy reinforced steel “U” channel frame to encompass entire perimeter of opening, foamed-in-place to give extra support and rigidity to frame and to prevent racking, distortion, warping and twisting. A backup must be welded for added strength.

One armored anti-sweat heater cable shall be run around freezer door frame in a breaker strip located behind a removable heavy gauge stainless steel trim for easy access to heater cable. Heater cable shall be run under threshold consisting of heavy reinforcement “U” channel breaker strip and heavy gauge stainless steel threshold. Also, provide an additional anti-sweat heater cable around perimeter of freezer door only.

Door section shall be provided with an operating toggle switch and pilot light mounted on the exterior side of the door frame. An LED vapor proof light and face mounted inlet box shall be mounted on the interior side of the door frame for 115 volt, 60 cycle, 1 phase A.C. service. All wiring shall be in concealed rigid conduit. A 2-1/2” diameter chrome face, flush mount, dual reading, adjustable dial thermometer shall be provided on exterior of door section to provide temperature reading of -40 degrees C to +150 degrees C.

Provide heavy duty stainless steel threshold with non-slip grip tape applied.

Door shall be fabricated for thin set mortar and quarry tile flooring in kitchen and Aluminum Diamond Treadplate in walk-in.
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VIEWPORT WINDOW:

For visual observation into the walk-in cooler and/or freezer a 14” x 14” view window shall be installed in each walk-in entrance door. Window shall be a three pane, heated, tempered safety glass (compliant with 2018 International Energy Conservation Code) to prevent frost formation and fog.
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TREADBRITE KICKPLATES:

Each door shall have 1/8" thick aluminum diamond treadbrite kickplates 36” high on the interior and exterior. Treadplate shall also be applied to exposed exterior cooler door panels. Kickplates shall be mounted with external fasteners and sealed with silicone.
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LED LIGHT FIXTURES:

Six (6) 4’ LED light fixtures each shall be provided in the Cooler and Freezer as shown on Food Service electrical plan sheet FS102.4. Light sources shall have an efficacy of not less than 40 lumens per Watt and shall be provided with a device that automatically turns off the lights within 15 minutes of vacancy of

compartment (compliant with 2018 International Energy Conservation Code.)
-

HEATED PRESSURE RELIEF VENT:

Freezer shall be equipped with a two-way heated pressure relief vent to equalize pressure between the interior and exterior caused by defrost cycles and opening of door. Electrical service to be 115v/60/1 phase.
-

TRIM AND ENCLOSURES:

S/S trim, matching the walk-in finish and fabricated to fit building conditions, shall be supplied to close all joints between walk-in and building walls.
-

ALARM:

Walk-in shall be equipped with audio-visual alarm(s) that activate when temperature rises above desired setting. Alarm sensor is to be located in the return air stream of evaporator coil. Control panel shall be located at front of walk-in or at other pre-specified location. When temperature rises above predetermined setting a red light and buzzer activates. Alarm must also be tied into BAS monitoring system. See the specification section that addresses Building Automation Systems for additional details. All school monitoring system requirements shall be coordinated with Director of School Facilities.
-

Basic refrigeration components shall consist of remote SCROLL condensing units (Hermetic or Semi-Hermetic not acceptable). Condensing units shall be factory assembled and UL approved. The condenser(s) shall be air-cooled. Refrigerant for medium and low temperature systems shall be R448A.

Refrigeration package shall include condensing unit, evaporator coil, control kit (pressure control, thermostat, liquid line drier, sight glass, suction line vibration eliminator, low-pressure cut-out switch, expansion valve and evaporator coil mounting kit), defrost timer, fan delay control and liq-uid line solenoid. All parts shall be factory mounted. Each condensing unit shall be completely factory assembled, piped, wired, tested and run-in. Each unit shall contain at least the following components: Heavy gauge housing for outside use, scroll motor compressor with built-in overload protection; aluminum-finned, copper tube, air-cooled condenser with direct driven condenser fan, arranged for horizontal air flow; refrigerant receiver with inlet, outlet, purge, relief and charging valves; suction and discharge line vibration eliminators; defrost controls, low-ambient pressure and starting controls and safety operating controls.

Provide sufficient BTUs for balanced refrigeration systems to accomplish operating temperature of 34 degrees F in cooler and -10 degrees F in freezer. BTU calculations are to be based on heavy us-age, an ambient temperature of 110 degrees F, 16 hours a day run time in coolers and 18 hours a day run time in freezers.

Remote condensing units to be set level on roof curbs with isolation absorbers and located within 100 ft (including both horizontal and vertical refrigeration line runs) of walk-in(s). Condensers shall be located to maintain proper air flow and shall not be placed back-to-back.

Remote Preassembled system requires tubing, electrical hook-up, drain line and refrigerant charge supplied by qualified refrigeration, electrical and plumbing contractors.

A low ambient kit and weatherproof housing shall be supplied with condensing units. The low am-bient kit

shall consist of a crankcase heater and headmaster valve no less than 148#.

Evaporator coils shall be ceiling mounted, low-profile, propeller-fan, free 30 delivery type arranged for horizontal air flow. Evaporator(s) shall be copper tube, aluminum-finned construction housed in a heavy-gauge aluminum casing.

Cooler evaporator coil(s) shall be air defrost. Freezer evaporator coil(s) shall be electric defrost. Provide with Electronically Commutated Motors required to meet 2009 Energy Code. Fixed fan speed motors not acceptable.

Evaporator coil(s) defrost system shall include programmable controllers for temperature and defrost control, time clock, fan delay control, drain line heaters and liquid line solenoid. Operating control shall be automatic recycling, low pressure cut-out switch. Low ambient control system shall be fully automatic and shall not require any auxiliary heat or heated receivers. Coordinate defrost schedule programming of all evaporator coils with Director of School Facilities.

Provide Temperature Sensor for each walk-in compartment and evaporator control. Probe shall be mounted away from evaporator coil towards entrance door.
-

NSF CONSTRUCTION:

The walk-ins provided in the above specifications shall be constructed in accordance with National Sanitation Foundation, Standard No. 7. The NSF approval seal shall be affixed to the serial plate of the walk-in.
-

QUALITY INSPECTION REQUIREMENTS:

Walk-ins shall be set up at the manufacturer's facility prior to shipment and a quality control inspection performed on the product. A digital photograph of the walk-ins set up at the manufacturer's facility shall be provided for the KES' permanent records.
-

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS:

The walk-ins shall be supplied with a complete set of installation, operational and maintenance instructions to cover erection of the walk-in, installation operating procedures and routine maintenance schedule.
-

NOTE: A Bally Refrigeration representative is to inspect the walk-in installation prior to start-up. Start-up, and service by FACTORY AUTHORIZED PERSONNEL ONLY, as coordinated by the KES.
-

NOTES:
1.KES shall be responsible for delivering and erecting walk-in and completing installation of refrigeration systems including drain lines. All plumbing and electrical hook up of condensing units, evaporator coils, lights, and door heater is to be by GC with coordination by the KES.
2. GC shall provide and install mounting rack for all refrigeration equipment on rooftop.
3. See detail 1E sheet FS101.1 for typical walk-in wiring details.
4. KES shall on-site field verify all wall dimensions around the walk-in prior to ordering walk-in.

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ITEM 011 - WALK-IN COOLER REMOTE CONDENSING UNIT (1 REQ'D) <Included>
Bally Refrigerated Boxes Model BEZA020-H8-HT3DB
Condensing Unit (for Walk-in Cooler)
Description: Remote Pre Assembled Refrig. System Model, Medium Temperature, base, weather hood, winter controls, Scroll, Air-cooled, R448A.
Horsepower: 2hp
Electrical: 208-230/60/3ph, 14.4 MCA, 25 MOPD, 10.6 Compressor amps
Room Temp: 34°F Ambient: 95°F

EC shall Provide disconnect(s).

ITEM 012 - WALK-IN COOLER EVAPORATOR COILS (2 REQ'D) <Included>
Bally Refrigerated Boxes Model BLP209MA-S1D-SV+
Evaporator (for Walk-in Cooler)
Description: Air defrost medium profile evaporator coil with EC fan motors and Smartvap+ Controller.
Electrical: 120/1ph, 2 amps, 2.3 MCA, 15 MOPD
Plumbing: 3/4" dia. condensate drain

EC shall provide switch at unit and ALL necessary components and wiring to make the refrigeration system operational. See Detail 1E - Sheet FS101.1 for details.

ITEM 013 - WALK-IN FREEZER (1 REQ'D) <Included>
Bally Refrigerated Boxes Model -
See item 010 for specifications and detailed info.

ITEM 014 - WALK-IN FREEZER REMOTE CONDENSING UNITS (2 REQ'D) <Included>
Bally Refrigerated Boxes Model BEZ1030-L8-HT3DB
Condensing Unit (for Walk-in Freezer)
Description: Remote Pre Assembled Refrig. System Model, Low Temperature, base, weather hood, winter controls, Scroll, Air-cooled, R448A.
Horsepower: 3.0hp
Electrical: 208-230/60/3ph, 13.5 MCA, 20 MOPD, 9.9 Compressor amps
Room Temp: -10°F Ambient: 95°F

EC shall provide disconnect(s).

ITEM 015 - WALK-IN FREEZER EVAPORATOR COILS (2 REQ'D) <Included>
Bally Refrigerated Boxes Model BLP209LE-S2D-SV+
Evaporator (for Walk-in Freezer)
Description: Electric defrost medium profile evaporator with EC fan motors and Smartvap+ Controller.
Electrical: 208/1ph, 8.2 amps, 10.3 MCA, 15 MOPD
Plumbing: 3/4" dia. condensate drain

EC shall provide switch at unit and ALL necessary components and wiring to make the refrigeration system operational. See Detail 1E - Sheet FS101.1 for details.

ITEM 016 - WALK-IN STORAGE DUNNAGE RACKS (5 REQ'D)
Cambro Model DRS480131

S-Series Dunnage Rack, slotted top, 3000 lb. load capacity, 21"D x 48"W x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, dark brown, NSF

ITEM 017 - WALK-IN STORAGE SHELVING (28 REQ'D)
Metro Model -
Walk-in storage shelving (4 tier) consisting of the following:

40 ea Model MX2460G MetroMax® i Shelf, 60"W x 24"D, reinforced type 304 stainless steel corners, removable open grid polymer mats, (4) wedge connectors, built in Microban® antimicrobial product protection, 750 lb. capacity per shelf, NSF

28 ea Model MX2454G MetroMax® i Shelf, 54"W x 24"D, reinforced type 304 stainless steel corners, removable open grid polymer mats, (4) wedge connectors, built in Microban® antimicrobial product protection, 750 lb. capacity per shelf, NSF

44 ea Model MX2448G MetroMax® i Shelf, 48"W x 24"D, reinforced type 304 stainless steel corners, removable open grid polymer mats, (4) wedge connectors, built in Microban® antimicrobial product protection, 1000 lb. capacity per shelf, NSF

112 ea Model MX63UP Polymer trilobal post (compatible with MetroMax® i, MetroMax® 4, MetroMax® Q), 63" H, for use with stem casters, adjusts at 1" increments, corrosion proof all polymer construction with built in Microban® antimicrobial product protection

112 ea Model 5PCBX Polymer Stem Caster, brake, 5" dia., 1-1/4"W face, -20° F to 120°F temperature range, polyurethane wheel tread, 300 lb. capacity, NSF (donut bumpers included) (for use with all MetroMax posts & shelves)

ITEM 018-019 - SPARE NO. <Spare No.>

ITEM 020 - S/S PREP TABLE WITH TWO SINKS AND DRAWER (1 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Prep Table with sinks, size and shape per plan, 35" H with 8-1/2"H backsplash as follows:
1. 14/304 stainless steel top and splash
2. Box marine edge on front and sides
3. 16/304 stainless steel undershelf
4.1-1/2" rear upturn for undershelf
5. All welded construction, legs, undershelf and top
6. Stainless steel legs
7. Bullet Feet, stainless steel, NSF
8. (1)24" x 24" x 14" bowl welded into top, as per plan
9. (1)24" x 24" x 10" bowl welded into top w/ disposer provision.
10. Disposer control mounting bracket.
11. Drawer, stainless steel face, stainless steel removable pan, 20" x 20" drawer enclosure, XHD ball bearing slides

1 ea T&S Brass Model B-0231 Sink Mixing Faucet, 12" swing nozzle, wall mounted, 8" centers on sink faucet with 1/2" IPS eccentric flanged female inlets, lever handles

1 ea T&S Brass Model B-0199-01 Aerator, non-splash, 55/64" -27 female aerator threads, fits goosenecks & nozzles

1 ea T&S Brass Model B-0230-K Installation Kit , (2) 1/2" NPT nipples, lock nuts and washers, (2) short "Ell" 1/2" NPT female x male

1 ea T&S Brass Model B-0199-01 Aerator, non-splash, 55/64" -27 female aerator threads, fits goosenecks & nozzles

1 ea T&S Brass Model B-0133-B EasyInstall Pre-Rinse Unit, wall mount. base faucet with spring check cart. & lever handles, 2" diameter flanges with 1/2" NPT female eccentric flanged inlets, 35-1/2"H, 15" overhang, 8-1/4" clearance, 18" riser, B-0107 spray valve, B-0044-H flex stainless steel hose, 6" wall bracket

1 ea T&S Brass Model B-0230-K Installation Kit , (2) 1/2" NPT nipples, lock nuts and washers, (2) short "Ell" 1/2" NPT female x male
1 ea T&S Brass Model B-0107-J MODIFIED WITH Spray Valve, with low-flow spray tip, 1.07 gpm flow rate, 7.2 Ozf spray force, self-closing, gray, EPAct 2005 compliant
1 ea Component Hardware Model D10-7415 Encore® Lever Handle Waste Outlet, with overflow assembly, 2" NPT, 3-1/2" sink opening, self-centering stainless steel face flange, 20 gpm max flow rate, flat snap-in stainless steel strainer, stainless steel lever handle, overflow head with stainless steel faceplate, nickel plated cast brass drain body

NOTES:
1. All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.
3. Anchor table and pre-rinse hose bracket to wall; use of “Z” clips required, no exposed fasteners.
4. The mounting bracket for Disposer Control Unit shall be mounted to underside of table, shall be large enough to secure control at top and bottom of unit and is to be recessed back far enough so as to not cause any accidental starting of disposer by food service personnel.

ITEM 021 - DISPOSER AND CONTROL (1 REQ'D)
InSinkErator Model SS-200-18A-AS101
SS-200™ Complete Disposer Package, with 18" diameter bowl, 6-5/8" diameter inlet, with removable splash baffle & reversible bowl cover, 2 HP motor, stainless steel construction, includes syphon breaker, (2) solenoid valves, (2) flow control valves, programmable AquaSaver® Control Center AS-101 with water-saving technology, automatic water saving function, auto reversing, timed run, post flush, adjustable leg kit
1 ea Standard height disposer body
1 ea 208v/60/3-ph, 3.6 amps
1 ea Model SYPHON STD Syphon breaker standard, 1/2" (11477)
1 ea (3) years parts & labor warranty from date of installation (standard)

NOTE: See sheet FS101.1 for typical wiring and plumbing details.

ITEM 022 - S/S OVERSHELVES (4 REQ'D)
Florida Stainless Fabricators Model -
S/S wall mounted overshelves consisting of the following:
2 ea Model CUSTOM Shelf, wall-mounted, 24"W x 12"D x 12-1/2"H, 16/304 stainless steel construction, 1-1/2" lip on sides & rear, 3/4" radius rolled front edge, stainless steel brackets, NSF.
2 ea Model CUSTOM Shelf, wall-mounted, 48"W x 12"D x 12-1/2"H, 16/304 stainless steel construction, 1-1/2" lip on sides & rear, 3/4" radius rolled front edge, stainless steel brackets, NSF.

NOTE: All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

ITEM 023 - FOOD CUTTER (1 REQ'D)
Hobart Model 84186-1
Food Cutter with #12 attachment hub, 18" diameter stainless steel bowl 20 RPM, double stainless steel knives 1725 RPM, bowl cover with safety interlock, push/pull on/off switch, one-piece burnished aluminum housing, 3" legs, 115v/60/1-ph, 1 HP, 6' cord with plug

1 ea Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA

ITEM 024 - S/S CUTTER TABLE (1 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Cutter table, size and shape per plan, 31 7/8" H, no backsplash and as follows:
1. 14/304 stainless steel top
2. Square edge table
3. All welded construction, legs, undershelf and top
4. 16/304 stainless steel undershelf with marine edge
5. 1-1/2" rear upturn for undershelf
6. stainless steel legs
7. Bullet Feet, stainless steel, NSF

1. All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

ITEM 025 - S/S HAND SINKS WITH SIDE SPLASHES (8 REQ'D)
Advance Tabco Model 7-PS-70
Hand Sink, wall mounted, 14" wide x 10" front-to-back x 5" deep bowl, 20 gauge 304 stainless steel, double splash faucet holes (no faucets), basket drain, wall bracket, NSF, cCSAus
8 ea T&S Brass Model B-0230-K Installation Kit , (2) 1/2" NPT nipples, lock nuts and washers, (2) short "Ell" 1/2" NPT female x male
8 ea T&S Brass Model B-1146-04-WS Workboard/Bar Sink Faucet, wall mount, 4" centers, modified with 132x-V05 gooseneck faucet , 4" wrist handles, 1/2" NPT, ADA compliant
8 ea T&S Brass Model 132X-V05 Nozzle, swivel, 8-9/16"H, 2-7/8" spread, gooseneck, 0.5 GPM VR non-aerated spray device, low lead, cCSAus, NSF
8 ea Model 7-PS-14 P-trap, 1-1/2", 22 gauge
8 ea Model 7-PS-15 Welded Side Splash, 12"H (installed height), both sides, for hand sinks with 14" wide x 10" front-to-back bowl, splash mounted faucets

NOTES:
1. All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.
3. Soap and towel dispensers by Owner.

ITEM 026 - SPARE NO. <Spare No.>

ITEM 027 - TWO DOOR REACH-IN REFRIGERATOR (1 REQ'D)
Continental Refrigerator Model D2RNSS Dimensions: 83.25(h) x 52(w) x 35.38(d)
Designer Line Refrigerator, reach-in, two-section, self-contained refrigeration, stainless steel exterior & interior, standard depth cabinet, full-height stainless steel doors, cylinder locks, electronic control with digital display, hi-low alarm, unit comes standard with expansion valve, 6" stainless steel legs, R290 hydrocarbon refrigerant, 1/4 HP, cETLus, NSF
1 ea 115v/60/1-ph, 6.9 amps, cord, NEMA 5-15P, standard
1 ea Hinging as per plan

1 st Model 50177-4 Casters, swivel, with brakes (5" diameter rubber tires) set of 4 (6" height)
1 ea Standard warranty 3 year parts and labor; additional 4 year compressor part

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ITEM 028 - S/S PREP TABLE WITH SINK (1 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Prep Table with sink, size and shape per plan, 35" H with 8-1/2"H backsplash as follows:
1. 14/304 stainless steel top and splash
2. Square edge on front and sides
3. 16/304 stainless steel undershelf
4. 1-1/2" rear upturn for undershelf
5. All welded construction, legs, undershelf and top
6. Stainless steel legs
7. Bullet Feet, stainless steel, NSF
8. (1) 20" x 20" x 14" bowl welded into top, as per plan
9. Drawer, stainless steel face, stainless steel removable pan, 20" x 20" drawer enclosure, XHD ball bearing slides

1 ea T&S Brass Model B-0231 Sink Mixing Faucet, 12" swing nozzle, wall mounted, 8" centers on sink faucet with 1/2" IPS eccentric flanged female inlets, lever handles
1 ea T&S Brass Model B-0199-01 Aerator, non-splash, 55/64" -27 female aerator threads, fits goosenecks & nozzles
1 ea T&S Brass Model B-0230-K Installation Kit , (2) 1/2" NPT nipples, lock nuts and washers, (2) short "Ell" 1/2" NPT female x male
1 ea Component Hardware Model D10-7415 Encore® Lever Handle Waste Outlet, with overflow assembly, 2" NPT, 3-1/2" sink opening, self-centering stainless steel face flange, 20 gpm max flow rate, flat snap-in stainless steel strainer, stainless steel lever handle, overflow head with stainless steel faceplate, nickel plated cast brass drain body

NOTE: All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

ITEM 029 - S/S OVERSHELF (1 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Shelf, wall-mounted, 96"W x 12"D x 12-1/2"H, 16/304 stainless steel construction, 1-1/2" lip on sides & rear, 3/4" radius rolled front edge, stainless steel brackets, NSF.

NOTE: All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

ITEM 030-036 - SPARE NO. <Spare No.>

ITEM 037 - S/S FOUR COMPARTMENT SINK WITH DRAINBOARDS (1 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Stainless steel four compartment, 35" high with 8 1/2" backsplash, size and shape per plan and as follows:

1. 14/304 stainless steel construction, top and splash
2. (3) 14/304 - 30" wide x 24" front-to-back x 14" deep bowls
3. (1) 14/304 - 20" wide x 24" front-to-back x 14" deep bowl with scrap basket
4. Drainboards on left and right

5. (3) sets of 8" O.C. splash mount faucet holes
6. All welded construction, crossbracing, legs, undershelf on left, and top
7. 16/304 stainless steel legs and crossbracing
8. Bullet Feet, stainless steel
9. (4) Lever waste brackets
10. NSF

2 ea T&S Brass Model B-0231 Sink Mixing Faucet, 12" swing nozzle, wall mounted, 8" centers on sink faucet with 1/2" IPS eccentric flanged female inlets, lever handles
1 ea T&S Brass Model B-0199-01 Aerator, non-splash, 55/64" -27 female aerator threads, fits goosenecks & nozzles
1 ea T&S Brass Model B-0133-12-CR-B EasyInstall Pre-Rinse Unit, spring action gooseneck, 8" wall mount, spray valve (B-0107), 12" add-on faucet, ceramic faucet, wall bracket
1 ea T&S Brass Model B-0107-J MODIFIED WITH Spray Valve, with low-flow spray tip, 1.07 gpm flow rate, 7.2 Ozf spray force, self-closing, gray, EPAct 2005 compliant
4 ea T&S Brass Model B-0230-K Installation Kit , (2) 1/2" NPT nipples, lock nuts and washers, (2) short "Ell" 1/2" NPT female x male
4 ea Component Hardware Model D10-7415 Encore® Lever Handle Waste Outlet, with overflow assembly, 2" NPT, 3-1/2" sink opening, self-centering stainless steel face flange, 20 gpm max flow rate, flat snap-in stainless steel strainer, stainless steel lever handle, overflow head with stainless steel faceplate, nickel plated cast brass drain body

NOTES:
1. All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.
2. Anchor table and pre-rinse hose bracket to wall; use of “Z” clips required, no exposed fasteners.

ITEM 038 - S/S OVERSHELF WITH POT RACK (1 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Shelf, wall mount with pot rack, 132"W x 12"D x 12-1/2"H, 16/304 stainless steel construction, 1-1/2" lip on sides & rear, 3/4" radius rolled front edge, stainless steel brackets, flat bar pot rack with double-pronged pot hooks (one per linear foot), NSF.

NOTE: All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

ITEM 039 - FLOOR TROUGH (1 REQ'D)
IMC/Teddy Model FWR-120-SG-ADA
FWR Floor Water Receptacle, 120"W x 7-1/2"D, 4" deep receptacle, (2) 4" OD tailpieces, stainless steel beehive strainer, 14/304 stainless steel construction, brushed satin finish, (SG) subway grating, NSF, Made in USA
1 lt SG-ADA Grating

NOTES:
1. All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.
3. Provided by KES; Installed by GC. KES shall on-site field verify roughed-in drain locations prior to fabrication.

ITEM 040 - BUN PAN RACKS (28 REQ'D)
Channel Manufacturing Model 406A
Bun Pan Rack, mobile, 20-1/2"W x 26"D x 64"H, front load, open sides, 3" spacing, capacity (18) 18" x 26" bun pans, welded aluminum construction, 5" swivel plate casters with non-marking tread, NSF, Made in USA (published shipping weight does not reflect 50lb. pallet)

ITEM 041 - CAN OPENERS (2 REQ'D)
Edlund Model S-11
Can Opener, manual, stainless steel, with cast stainless steel base, NSF certified
2 ea 5 year limited warranty, standard

ITEM 042 - MIXER (60 QT) (1 REQ'D)
Hobart Model HL600-2
380-460/50/60/3 Mixer; without attachments; US/EXP configuration - Legacy Planetary Mixer - Unit Only, 2.7 HP, 60 quart capacity, (4) fixed speeds, gear-driven transmission, 20-Minute SmartTimer™, #12 taper attachment hub, power bowl lift, stainless steel bowl guard
1 ea Model BOWL-HL60 Legacy® Mixer Bowl, 60 quart, stainless steel
1 ea Model BBEATER-HL60 Legacy® Mixer 60 qt. "B" flat beater, aluminum
1 ea Model DWHIP-HL60 Legacy® Mixer 60 quart "D" wire whip, stainless steel
1 ea Model EDDOUGH-HL60 Legacy® Mixer 60 qt. "ED" dough hook
1 ea Model EDOUGH-HL60 60 qt. "E" Dough Hook
1 ea Model IWIRE-HL60 60 qt. "I" Heavy Duty Wire Whip
1 ea Model PPASTRY-HL60 60 qt. "P" Pastry Knife
1 ea Model SPLASH-LEX060 Mixer Bowl Splash Cover, for 60 quart, Lexan
1 ea Model CHUTE-HL HL600/HL662 Ingredient Chute
1 ea Model TRUCK-HL1486 Legacy® Mixer Bowl Truck, aluminum, for use with 60, 80 & 140 quart mixers
1 ea Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA
1 ea K-12 School Nutrition extended warranty extends the warranty for 12 months beyond the 12 month Original Equipment Warranty, not to exceed 24 months from date of installation
1 ea Standard warranty: 1-Year parts, labor & travel time during normal working hours within the USA
1 ea K-12 School Nutrition extended warranty extends the warranty for 12 months beyond the 12 month Original Equipment Warranty, not to exceed 24 months from date of installation

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ITEM 043 - S/S BAKER'S TABLE WITH DRAWERS AND OVERSHELF (1 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Baker's Work Table with overshelf, size and shape per plan, 35" H with 4-1/2"H back and side splashes as follows:
1. 14/304 stainless steel top and splashes
2. End splashes (as per plan)
3. Square edge table
3. 16/304 series table mounted stainless steel overshelf
5. All welded construction, legs, cross-rails, top and overshelf
6. Cross-railed open base design
7. (6) stainless steel legs
8. Bullet Feet, stainless steel, NSF
9. (3) Heavy Duty Drawer Assemblies, 20" x 20" x 5", 304 type stainless steel, insulated drawer front, removable drawer pans, self-closing drawer slides, stackable, hemmed safety pull handle

NOTE: All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

ITEM 044 - INGREDIENT BINS (4 REQ'D)
Cambro Model IBS20148
Ingredient Bin, mobile, 21 gallon capacity, molded polyethylene with sliding cover, S-hook on front (scoop NOT included), (4) 3" heavy duty casters (2 front swivel, 2 fixed), with bin securely attached to base plate, white with clear cover, NSF

ITEM 045 - S/S WORKTABLES (3 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Worktable, Size size & shape per plan, 35"H, NO backsplash as follows:

1. 14/304 stainless steel top
2. Square edge table
3. 16/304 series stainless steel undershelf
4. 1-1/2" rear upturn for undershelf
5. All welded construction, legs, undershelf and top
6. Stainless steel legs
7. Flanged Feet, stainless steel and secured to floor (non-movable) for installation of item 048 electrical chase

NOTE: All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

ITEM 046 - S/S WORKTABLES WITH DRAWER AND OVERSHELF (2 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Worktable with drawer and overshelf, size size & shape per plan, 35"H table

1. 14/304 stainless steel top and 4 1/2" high backsplash
2. Square edge table
3. 16/304 series stainless steel undershelf and table mounted overshelf
4. 1-1/2" rear upturn for undershelf
5. All welded construction, legs, undershelf, top and overshelf
6. (4) stainless steel legs
7. Bullet Feet, stainless steel, NSF
8. Drawer, stainless steel face, stainless steel removable pan, 20" x 20" drawer enclosure, XHD ball bearing slides

NOTE: All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

ITEM 047 - S/S WORKTABLES WITH DRAWER AND OVERSHELF (2 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Worktable with drawer and overshelf, size size & shape per plan, 35"H table

1. 14/304 stainless steel top and 4 1/2" high backsplash
2. Square edge table
3. 16/304 series stainless steel undershelf and table mounted overshelf
4. 1-1/2" rear upturn for undershelf
5. All welded construction, legs, undershelf, top and overshelf
6. (6) stainless steel legs
7. Bullet Feet, stainless steel, NSF
8. Drawer, stainless steel face, stainless steel removable pan, 20" x 20" drawer enclosure, XHD ball bearing slides

NOTE: All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

ITEM 048 - S/S ELECTRICAL CHASES (3 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Stainless steel electrical chase, 94" L (verify) x 4.25" x 4.25", stainless steel, from ceiling (verify ceiling height prior to fabrication) to top of worktable, includes two (2) knock out boxes for electrical receptacles at 48" high A.F.F. on two (2) sides of chase as shown in the Foodservice electrical plan.

NOTES:
1. Mounts to item 045 worktable as shown on Foodservice plan.
2. EC to provide JB in ceiling and wire to two(2) NEMA 5-20R receptacles (also provided by EC), to be located in knock outs in chase.
3. All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

ITEM 049 - UTILITY DISTRIBUTION SYSTEM (1 REQ'D)
Captive-Aire Model -
Utility distribution system with provision to mount water filters as per plan. See sheets FS301.4 for specification and details.

ITEM 050 - S/S EXHAUST HOOD WITH MAKE-UP AIR (1 REQ'D)
Captive-Aire Model -
Kitchen exhaust hoods with exhaust fans, make-up air fans, fire suppression system and electrical system. See sheets FS301.1 - FS301.6 for specification and details. See A/E mechanical plan for locations of fans.

NOTE: HOODS AND FANS PROVIDED BY KES; INSTALLED BY GC. DUCTWORK PROVIDED AND INSTALLED BY GC.

ITEM 051 - DOUBLE DECK HYDROVECTION OVENS (3 REQ'D)
Blodgett Model HV-100G DBL
HydroVection™ Oven, Gas, full size, double stacked, capacity (10) 18" x 26" pans, (6) inshot burners, direct spark ignition, black glass doors, (4) halogen lamps, (10) stainless steel racks and (20) rack positions, cavity vent, programmable manual controls, four speed auto-reversing fan motor with overload protection, 4" fillet core probe & USB connection, side mounted hand shower, 304 stainless steel insulated interior liner, stainless steel front, top, sides & back, 8-1/2" stainless steel legs with casters and

stacking kit, (2) 3/4 HP, (2) 60,000 BTU, cETLus, NSF
3 ea Natural Gas
6 ea 115v/60/1-ph, 10.0 amps, NEMA 5-20R (per deck), standard
6 ea Water pressure regulator (per section)
3 ea Wire rack, stainless steel
3 ea 1 year parts and labor warranty, standard
3 kt Dormont Model 1675KIT2S48 Dormont Blue Hose™ Moveable Gas Connector Kit, 3/4" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (2) Swivel MAX®, (1) full port valve, (1) Snap'N Go, coiled restraining cable with hardware, 160,000 BTU/hr minimum flow capacity, limited lifetime warranty
3 kt Dormont Model 1675KITS48PS Dormont Blue Hose™ Moveable Gas Connector Kit, 3/4" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (1) Swivel MAX®, (1) full port valve, (1) elbow, (1) Snap'N Go, (1) pair Safety Set® with hardware mounting options, limited lifetime warranty
1 ea Everpure Model EV929324 Cold/Insurice Manifold, quad, 20" prefilter head, for fountain, ice, coffee and tea machines, built-in water pressure gauge, modular design of box bracket for components add-on, includes mounting box bracket & screws, E110 or E210 pre-filter cartridge & ScaleStick®

NOTES:
1. KES to mount water filters to Utility Distribution System.
2. EC to hardwire to UDS

ITEM 052 - COOK AND HOLD OVENS (2 REQ'D)
Alto-Shaam Model 1200-TH Dimensions: 70.63(h) x 22.56(w) x 33.25(d)
Halo Heat® Slo Cook & Hold Oven, electric, low-temperature, double-deck, standard depth, 120 lb. capacity each - (4) 12" x 20" x 2-1/2" full-size pans, simple or deluxe controls, LED display, (8) programmable menu buttons, (6) stainless steel wire shelves, (1) exterior drip tray with removable pan, heavy-duty stainless steel, 3-1/2" casters (2 rigid, 2 swivel with brakes), EcoSmart®, cULus, UL EPH Classified, CE, TUV NORD, IPX4, EAC
2 ea 208-240v/50/60/1-ph, 29.0-34.0 amps, 6.2-8.2 kW
2 ea NEMA 6-50P & 8 ft. cord
2 ea Deluxe Controls – Touch screen user interface with customizable home screen, programmable recipes, unlimited cook stages, recipe management, service diagnostics, and reporting on screen; enables access to ChefLinc™ remote oven management system to monitor ovens, view reports and push/pull recipes and oven settings via Wi-Fi or Ethernet connectivity
2 ea 2 Single point probes (DELUXE ONLY)
2 ea Door hinging per plan
2 ea Stainless steel exterior, standard
2 ea Casters, 3-1/2", standard

ITEM 053 - TILT SKILLET (40 GAL) (1 REQ'D)
Cleveland Range Model SGL40TR
DuraPan™ Tilting Skillet, gas, 40-gallon capacity, modular open base, standard with hydraulic hand tilt with quick lowering feature, stainless steel construction, includes spring-assisted cover, gallon markings and electronic spark ignition, food strainer, stainless steel level adjustable feet, 130,000 BTU, CE, NSF, IPX6
1 ea 120v/60/1-ph, 1.8 amps NEMA 5-15P, standard
1 ea Natural Gas

1 ea Standard controls, temperature control dial, LED ON indicator light, main power switch with standard and high power setting, standard
1 ea Model PT2 Power Tilt, with hand tilt override
1 ea Model TD2SK 2" tangent draw-off valve, front mounted left side, includes FSSK strainer
1 ea Model DPK13 Double Pantry Faucet, with 3/4" swing spout & mounting bracket, for T1 skillets, mounts on right side of unit
1 ea Model FSSK Food Strainer, 30 & 40 gallon, for braising pans, standard
1 ea 1-year parts & labor warranty, standard
1 ea Extended warranty, not to exceed 24 months from date of installation (for K-12 schools only)

1 kt Dormont Model 16100KIT2S48PS Dormont Blue Hose™ Moveable Gas Connector Kit, 1" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (2) Swivel MAX®, (1) full port valve, (1) pair Safety Set® with hardware mounting options, limited lifetime warranty

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ITEM 054 - S/S FLOOR TROUGH (1 REQ'D)
IMC/Teddy Model FT-3036-SG-ADA
FT Floor Trough, 36"W x 30"D, 4" deep receptacle, (1) 6-1/2" waste outlet with perforated waste basket & 4" OD tailpiece, includes anchor straps, 14/304 stainless steel construction, brushed satin finish, (SG) subway grating, NSF, Made in USA
1 lt SG-ADA Grating

NOTES:
1. All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.
3. Provided by KES; Installed by GC. KES shall on-site field verify roughed-in drain locations prior to fabrication.

ITEM 055 - TILT SKILLET (30 GAL) (1 REQ'D)
Cleveland Range Model SGL30TR
DuraPan™ Tilting Skillet, gas, 30-gallon capacity, modular open base, standard with hydraulic hand tilt with quick lowering feature, stainless steel construction, includes spring-assisted cover, gallon markings and electronic spark ignition, stainless steel level adjustable feet, CE, NSF, 91,000 BTU, IPX6
1 ea Performance start-up included at customer request after equipment is installed (Free Water Quality Check included) (contact Cleveland Sales Representative for details)
1 ea Natural Gas
1 ea 120v/60/1-ph, 1.8 amps NEMA 5-15P, standard
1 ea Model PT1 Power Tilt, with hand tilt override
1 ea Model TD2SK 2" tangent draw-off valve, front mounted left side
1 ea Model DPK14 Double Pantry Faucet And Bracket
1 ea 1-year parts & labor warranty, standard
1 ea 10 Year Pan warranty (K-12 Schools only)
1 kt Dormont Model 16100KIT2S48 Dormont Blue Hose™ Moveable Gas Connector Kit, 1" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (2) Swivel MAX®, (1) full port valve, coiled restraining cable with hardware, 295,000 BTU/hr minimum flow capacity, limited lifetime warranty

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ITEM 056 - S/S FLOOR TROUGH (1 REQ'D)
IMC/Teddy Model FT-3030-SG-ADA

FT Floor Trough, 30"W x 30"D, 4" deep receptacle, (1) 6-1/2" waste outlet with perforated waste basket & 4" OD tailpiece, includes anchor straps, 14/304 stainless steel construction, brushed satin finish, (SG-ADA) subway grating, NSF, Made in USA
1 lt SG-ADA Grating

NOTES:
1. All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.
3. Provided by KES; Installed by GC. KES shall on-site field verify roughed-in drain locations prior to fabrication.

ITEM 057 - CONVECTION STEAMER (1 REQ'D)
Cleveland Range Model 24CGA10.2
Steamcraft® Gemini™ 10 Convection Steamer, pressureless, gas, 2 compartments with individual generators, (5) 12 x 20 x 2-1/2 pans/compartment capacity, SureCook controls, 60-minute mechanical timer & manual (continuous steaming) bypass switch, left-hand hinged door, controls on right, 1 standard treated & tap water connection, stainless steel construction, 6" adjustable legs with flanged feet, 144,000 BTU total
1 ea Natural Gas
1 ea (VOS115) 120v/60/1-ph, 2 blowers & controls, 150 watts each (DO NOT connect to GFI outlet)
1 ea 1-year parts & labor warranty, standard
1 ea Extended warranty, not to exceed 24 months from date of installation (for K-12 schools only)
1 ea 5 year pro-rated parts warranty on boilers & steam generators
2 ea 3 year Convection Steamer Door Warranty, standard
1 ea Everpure Model EV979722 KleenSteam II Twin System, 20,000 gallon capacity, 5.0 gpm flow rate, total system for steamers prevents limescale formation, (2) 7CB5 carbon filters, (1) SS-10 scale inhibitor Cartridge, dip tube, (2) 2.2 lbs. canisters ScaleKleen® (EV979722)
1 kt Dormont Model 1675KIT2S48 Dormont Blue Hose™ Moveable Gas Connector Kit, 3/4" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (2) Swivel MAX®, (1) full port valve, (1) Snap'N Go, coiled restraining cable with hardware, 160,000 BTU/hr minimum flow capacity, limited lifetime warranty

NOTE: EC to hardwire to UDS

ITEM 058 - COMBI OVEN ON STAND (1 REQ'D)
Alto-Shaam Model CTP10-20G
Combitherm® CT PROformance™ Combi Oven/Steamer, gas, boiler-free, countertop, (11) 18" x 26" full size sheet or (22) 12" x 20" full size hotel pan (1/1 GN) capacity, PROtouch control with steam/convection/combi and retherm cooking modes, programmable cool-down, SafeVent™ steam venting, removable single-point temperature probe, (3) power levels, (4) cooking modes, CombiClean PLUS™ with (5) cleaning levels, (2) side racks with (11) non-tilt support rails, CoolTouch3™ glass window, door hinged right, high efficiency LED lighting, stainless steel construction, adjustable stainless steel legs, 133,000 BTU, EcoSmart®, cULus, UL EPH Classified, CE, EAC, IPX5, Gastec
1 ea Natural Gas
1 ea Combi Oven/Steamer Unit, without CombiSmoker option, standard
1 ea 120v/60/1-ph, 6.8 amps, .84kW, 12 AWG, NO cord or plug
1 ea Removable single-point temperature probe, standard
1 ea Model 5015711 Combitherm® Combi Oven Stand, mobile, 28-15/16" x 38-3/4" x 38-5/16" (734mm x 983mm x 972mm), with pan slides and shelf, spacing 2-11/16" (68mm), stainless steel, for 7-20 or 10-20

1 ea Everpure Model EV979740 KleenSteam II Twin without Feeder, 20,000 gallon capacity, 5.0 gpm flow rate, total system for steamers prevents limescale formation, (2) 7CB5 carbon filters (EV979740)

NOTE: EC to hardwire to UDS

ITEM 059 - FLOOR TROUGH (3 REQ'D)
IMC/Teddy Model FWR-36-SG-ADA
FWR Floor Water Receptacle, 36"W x 7-1/2"D, 4" deep receptacle, (1) 4" OD tailpiece, stainless steel beehive strainer, 16/304 stainless steel construction, brushed satin finish, (SG-ADA) subway grating, NSF, Made in USA
3 lt SG-ADA Grating

NOTES:
1. All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.
3. Provided by KES; Installed by GC. KES shall on-site field verify roughed-in drain locations prior to fabrication.

ITEM 060 - TILE KETTLE (6 GAL) WITH BASE (1 REQ'D)
Cleveland Range Model 24EMK624
Kettle/Cabinet Assembly, electric, 24" wide cabinet base, (1) 6-gallon kettle, standard height cabinet, stainless steel interior & exterior finish with 316 series stainless steel liner, includes lift-off cover, double pantry faucet, splash guard, sink & drain, 24 kW
1 ea (VOS2) 440-480v/60/3-ph, 26.0 amps, 3-wire
1 ea 1-year parts & labor warranty, standard
1 ea Extended Warranty, not to exceed 36 months from date of installation (K-12 Schools only)
1 ea 5 year pro-rated parts warranty on boilers & steam generators

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ITEM 061 - SPARE NO. <Spare No.>

ITEM 062 - DISPOSER AND CONTROL (1 REQ'D)
InSinkErator Model SS-200-7-AS101
SS-200™ Complete Disposer Package, sink mount system, 6-5/8" diameter inlet, with #7 collar adaptor for sink installation, 2 HP motor, stainless steel construction, includes syphon breaker, (2) solenoid valves, (2) flow control valves, removable splash baffle, stainless steel sink stopper, programmable AquaSaver® Control Center AS-101 with water-saving technology, automatic water saving function, auto reversing, timed run, post flush, adjustable leg kit
1 ea 208v/60/3-ph, 3.3 amps
1 ea Standard height disposer body
1 ea Model SYPHON 45DEG Syphon breaker upgrade, chrome, 45° fittings (13412)
1 ea (3) years parts & labor warranty from date of installation (standard)

NOTE: Unit shall be interwired and interplumbed by the KES and made ready for final connections by the G.C. See Detail 2P – Sheet FS101.1 for typical installation detail.

ITEM 063 - ICE MAKER AND BIN (1 REQ'D)
Manitowoc Model IYT0900A
Indigo NXT™ Series Ice Maker, cube-style, air-cooled, self-contained condenser, 30"W x 24-1/2"D x 26-1/2"H, production capacity up to 865 lb/24 hours at 70°/50° (750 lb AHRI certified at 90°/70°), DuraTech™ exterior, half-dice size cubes, R410A refrigerant, NSF, cULus, CE, ENERGY STAR®
1 ea (-261) 208-230v/60/1-ph, 9.5 amps
1 ea Model D570 Ice Bin, 30"W x 34"D x 50"H, with side-hinged front-opening door, side grips, AHRI certified 532 lb ice storage capacity (17.9 cu. ft.), for top-mounted ice maker, Duratech exterior, NSF
1 ea Legs, 6" adjustable stainless steel, standard
1 ea Model WARRANTY-ICE-SC 3 year parts & labor (Machine), 5 year parts & labor (Evaporator), 5 year parts & 3 years labor (Compressor), standard
1 ea Model WARRANTY-BIN/DISP 3 year parts & labor warranty, standard

1 ea Everpure Model EV932422 Insurice Twin PF-i2000² Twin System, 18,000 gallon capacity, 3.34 gpm flow rate, 0.5-micron precoat filtration, (2) I2000² cartridges, with self-contained scale inhibitor feed, (1) EC210 sediment prefilter Cartridge, for cubers up to 1,450 lbs/day or flakers up to 2,200 lbs/day, pressure gauge, flushing valve, NSF, ANSI

ITEM 064 - S/S FLOOR TROUGH (1 REQ'D)
IMC/Teddy Model FT-1824-SG-ADA
FT Floor Trough, 24"W x 18"D, 4" deep receptacle, (1) 6-1/2" waste outlet with perforated waste basket & 4" OD tailpiece, includes anchor straps, 14/304 stainless steel construction, brushed satin finish, (SG-ADA) subway grating, NSF, Made in USA
1 lt SG-ADA Grating

NOTES:
1. All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.
3. Provided by KES; Installed by GC. KES shall on-site field verify roughed-in drain locations prior to fabrication.

ITEM 065 - GENERAL STORAGE SHELVING (6 REQ'D)
Metro Model -
General storage shelving (5 tier) consisting of the following:
10 ea Model 2460NK3 Super Erecta® Shelf, wire, 60"W x 24"D, Metroseal™ Green epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, plastic split sleeves are included in each carton, NSF
10 ea Model 2454NK3 Super Erecta® Shelf, wire, 54"W x 24"D, Metroseal™ Green epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, plastic split sleeves are included in each carton, NSF
10 ea Model 2436NK3 Super Erecta® Shelf, wire, 36"W x 24"D, Metroseal™ Green epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, plastic split sleeves are included in each carton, NSF
24 ea Model 74UPK3 Super Erecta® SiteSelect™ Post, 74"H, for use with stem casters, Metroseal 3™ epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection
24 ea Model 5MB Super Erecta® Stem Caster, brake (foot operated), 5" diameter, 1-1/4" face, resilient wheel tread, 200 lb. capacity, brakes are foot operated

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ITEM 066 - CHEMICAL STORAGE SHELVING (1 REQ'D)

Metro Model -
Chemical storage shelving unit (5 tier) consisting of the following:
5 ea Model 2448NK3 Super Erecta® Shelf, wire, 48"W x 24"D, plastic split sleeves are included in each carton, Metroseal 3™ epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, NSF
4 ea Model 74UPK3 Super Erecta® SiteSelect™ Post, 74"H, for use with stem casters, Metroseal 3™ epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection
4 ea Model 5MB Super Erecta® Stem Caster, brake (foot operated), 5" diameter, 1-1/4" face, resilient wheel tread, 200 lb. capacity, brakes are foot operated

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ITEM 067 - MOP SINK WITH SERVICE FAUCET (1 REQ'D) <By G/C>
General Contractor Model -
Mop Sink w/ service faucet. Provided and installed by GC.

See A/E plumbing sheets for details

ITEM 068 - MOP HANGERS (2 REQ'D)
Eagle Group Model 312688
Mop Holder, 18"W, holds (3) mops. Wall mounted. GC to provide wall backing.

ITEM 069 - HIGH PRESSURE CLEANING SYSTEM (1 REQ'D)
Spray Master Model 300-5176
Central Pressure Washer Cleaning System, wall mount, 2.2gpm @ 1000psi, 208v, 3-cylinder CAT plunger pump, dual solenoid chemical injector, 4 ft. manifold discharge hose, 6 ft. water supply hose, 2 HP motor, stainless steel cover, frame, wall mount brackets, UL, ETL, cETLus, CE
Includes One (1) remote station with 100' hose and sprayer.

1 ea Model SMT-TRAPSHOOT-W Trap Shooter Drain Cleaner, with 10' hose, Flo-Thru QC, for use with wall mount and portable systems
1 ea Model SMT-HUMMERJETJR Hummer Jet Jr.™ Floor & Surface Cleaner, Flo-Thru QC, high pressure rinse & low pressure soap, with caster ring, stainless steel straight lance
1 ea Model SMT-300HDR Hose Reel Model No. SMT-300HDR mobile Heavy Duty Hose Reel

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ITEM 070 - S/S SOILED DISHTABLE (1 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Spec-Master® Soiled Dishtable, right-to-left operation, size and shape as per plan, as follows:
1. 14/304 stainless steel top and rear and right-side splashes
2. Splash 8 1/2" high with turn down at back of splash per table with Z clip(s) at rear and on the right side of table
3. Raised rolled edges on front and front and left side
4. 1-1/2" rear upturn for undershelf
5. All welded construction, legs and top
6. Stainless steel legs and crossbracing
7. Bullet Feet, stainless steel, NSF
8. 20" x 20" x 5" Pre-rinse sink with faucet hole (NO basket waste), welded into top
9. Punching faucet holes, for wall-mount faucet on 8" centers behind pre-rinse sink
10. Disposal provision

1 ea T&S Brass Model B-0133-B EasyInstall Pre-Rinse Unit, wall mount. base faucet with spring check cart. & lever handles, 2" diameter flanges with 1/2" NPT female eccentric flanged inlets, 35-1/2"H, 15" overhang, 8-1/4" clearance, 18" riser, B-0044-H flex stainless steel hose, 6" wall bracket
1 ea T&S Brass Model B-0230-K Installation Kit , (2) 1/2" NPT nipples, lock nuts and washers, (2) short "Ell" 1/2" NPT female x male
1 ea T&S Brass Model B-0107-J MODIFIED WITH Spray Valve, with low-flow spray tip, 1.07 gpm flow rate, 7.2 Ozf spray force, self-closing, gray, EPAct 2005 compliant

NOTES:
1. All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.
3. Anchor table and pre-rinse hose bracket to wall; use of “Z” clips required, no exposed fasteners.
4. The mounting bracket for Disposer Control Unit shall be mounted to underside of table, shall be large enough to secure control at top and bottom of unit and is to be recessed back far enough so as to not cause any accidental starting of disposer by food service personnel.

ITEM 071 - POT AND PAN WASHER (1 REQ'D)
Hobart Model PW20ER-2
Advansys™ Ventless Pot/Pan/Utensil Washer with Energy Recovery, front loading with split door design, (20) pan capacity, over/under rotating arms, 2/4/6 minute adjustable timer, up to (13) racks/hour, includes: (2) flat grids, (2) tray racks & (1) flat bottom rack, pre-rinse spray hose, sanitizing with Sense-A-Temp™ 70° booster rise, internal condensing system, auto delime notification, vent fan control, stainless steel construction, 480v/60/3-ph, cULus, NSF, ENERGY STAR®
1 ea Model PW20ER-ELE0CD 480v/60/3-ph, standard
1 ea Model DWT-PW Drain water tempering kit
1 ea Installation of DWT kit only (NET)
1 ea Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA
1 ea Everpure Model EV979911 HTS-11 Kleenware™ System, Cartridge incorporates HydroBlend, a specially blended compound that inhibits limescale build-up and reduces corrosion (for cold water supply only)

ITEM 072 - S/S CONDENSATE HOOD (1 REQ'D)
Captive-Aire Model -
Stainless steel condensate hood with fan provided KES, installed by GC. Ductwork by GC. See sheets FS301.1 - FS301.6 in the Foodservice set for details. See A/E Mechanical sheets for fan location.

NOTE: CONDENSATE HOOD AND FAN PROVIDED BY KES; INSTALLED BY GC. DUCTWORK PROVIDED AND INSTALLED BY GC.

ITEM 073 - S/S CLEAN SORTING DISHTABLE (1 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Stainless steel clean sorting dishtable, size and shape as per plan, as follows:
1. 14/304 stainless steel top and backsplash
2. Splash 8 1/2" high with turn down at back of splash per table with Z clip(s)
3. Raised rolled edges on front and sides
4. Open cross-rail base
5. All welded construction, legs, undershelf and top
6. Stainless steel legs and crossbracing
7. Weep drain hole

8. Bullet Feet, stainless steel, NSF

NOTES:
1. All materials, gauges, finishes and construction shall be in accordance with the Section 114000 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.
2. Anchor table and pre-rinse hose bracket to wall; use of “Z” clips required, no exposed fasteners.

ITEM 074 - S/S OVERSHELVES (2 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Shelf, wall-mounted, 72"W x 12"D x 12-1/2"H, 16/304 stainless steel construction, 1-1/2" lip on sides & rear, 3/4" radius rolled front edge, stainless steel brackets, NSF.

NOTES:
1. All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

ITEM 075 - DISHROOM STORAGE SHELVING (4 REQ'D)
Metro Model -
DIshroom storage shelving (5 tier) consisting of the following:

20 ea	Model 2448NK3 Super Erecta® Shelf, wire, 48"W x 24"D, plastic split sleeves are included in each carton, Metroseal 3™ epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, NSF
16 ea	Model 74UPK3 Super Erecta® SiteSelect™ Post, 74"H, for use with stem casters, Metroseal 3™ epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection
16 ea	Model 5MB Super Erecta® Stem Caster, brake (foot operated), 5" diameter, 1-1/4" face, resilient wheel tread, 200 lb. capacity, brakes are foot operated

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ITEM 076 - S/S FLOOR TROUGH (1 REQ'D)
IMC/Teddy Model FWR-84-SG-ADA
FWR Floor Water Receptacle, 84"W x 7-1/2"D, 4" deep receptacle, (1) 4" OD tailpiece, stainless steel beehive strainer, 16/304 stainless steel construction, brushed satin finish, (SG-ADA) subway grating, NSF, Made in USA

NOTES:
1. All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.
3. Provided by KES; Installed by GC. KES shall on-site field verify roughed-in drain locations prior to fabrication.

ITEM 077 - ROLL-THRU HEATED CABINETS (4 REQ'D)
Continental Refrigerator Model DL2WI-SS-RT Dimensions: 86(h) x 68.5(w) x 38.75(d)
Designer Line Warmer, roll-thru, two-section, stainless steel exterior & interior, standard depth cabinet, full-height solid doors, electronic control with digital display, hi-low alarm, cETLus, NSF

4 ea	208-230v/60/1, 3.0 kW, 13.8 amps, cord & plug supplied by others
4 ea	Hinging as per plan
4 ea	Standard warranty 3 year parts and labor

NOTE: Electrician to provide cord and plug

ITEM 078 - ROLL-THRU REFRIGERATORS (4 REQ'D)
Continental Refrigerator Model D2RINSSRT Dimensions: 86(h) x 68.5(w) x 38.75(d)
Designer Line Refrigerator, roll-thru, two-section, self-contained refrigeration, stainless steel exterior & interior, standard depth cabinet, full-height solid doors, cylinder locks, electronic control with digital display, hi-low alarm, unit comes standard with expansion valve, removable stainless steel ramps, R290 hydrocarbon refrigerant, 1/2 HP, cETLus, NSF
4 ea 115v/60/1-ph, 9.4 amps, cord & plug, standard
4 ea Hinging as per plan
4 ea Standard warranty 3 year parts and labor; additional 4 year compressor part

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ITEM 079-083 - SPARE NO. <Spare No.>

ITEM 084 - OPEN AIR REFRIGERATED MERCHANDISERS (6 REQ'D)
Federal Industries Model RSSM478SC
Specialty Display High Profile Self-Serve Refrigerated Merchandiser, 47-1/4"W x 35-1/4"D x 78”H, self contained refrigeration, energy saving night curtain, 3500K LED top light, (4) tiers of adjustable black metal shelves, stainless steel display deck, black interior, tempered glass ends, choice of laminate, designed for continuous lineups, cULus, UL EPH Classified, Made In USA, DOE 2017 compliant
6 ea Self-contained refrigeration standard
6 ea 208-240v/60/1-ph, standard
6 ea Cord & plug (6 ft)
6 ea Laminate special color (Formica/Wilsonart) standard offerings
6 ea Black trim
6 ea Reflective end glass (pair)
6 ea Security night cover,black polycarbonate, removable
6 ea Additional shelf with LED light (per tier)
6 ea Slanted milk crate insert
6 ea 2-1/2" Casters with skirt (includes cord & plug)
6 ea 48" Sliding rear access doors, includes stainless remainder of back
6 ea One year parts & labor warranty, standard
6 ea Five year compressor warranty, standard (for self-contained units only)

NOTE: KES TO VERIFY FINAL LAMINATE SELECTION WITH OWNER

ITEM 085 - HEATED DISPLAY MERCHANDISERS (4 REQ'D)
Hatco Model HXMS-36D
Slant Heated Merchandiser with LED Lighting Warmer, 36" W, countertop, dual shelf, (14) divider rods, (3) bulbs per shelf, thermostat, infrared heat, hardcoat aluminum base, tempered side glass hinged to post, cULus, UL EPH Classified, Made in USA
4 ea One year on-site parts and labor warranty, plus one additional year parts only warranty on all Glo-Ray metal sheathed elements
4 ea 120/208v/60/1-ph, 2200 watts, 9.2 amps, NEMA L14-20P (Domestic voltage), standard
NOTE: KES to verify final color with Owner.

ITEM 086-089 - SPARE NO. <Spare No.>

ITEM 090a - TRAY STANDS (2 REQ'D)
Low Temp Industries Model CUSTOM
Tray stand, as follows:

1. 14/304 stainless steel top and sides
2. Square edge top
3. 14/304 side angles, 2" high
4. Four (4) 5" Polymer casters; two (2) fixed casters in the front, two (2) swivel casters with brakes at the rear.
6. Type 304 stainless steel handle
7. NSF

ITEM 090b - HOT/ COLD FOOD CONVERTIBLE SERVING COUNTERS (2 REQ'D)
Low Temp Industries Model CUSTOM
Hot/ cold food serving counter with four (4) individual quickswitch hot/cold wells, all glass adjustable sneezeguard, two-tier heated ceramic shelves as follows:

1. Solid surface top
2. Square edge top
3. 18/304 cabinet with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Enclosed rear cabinet with hinged door mechanical access; doors 18/304 s/s double pan and insulated.
5. 18/304 s/s shelves (where necessary) sectional and removable.
6. Two (2) sets of two (2) quickswitch wells - 18 ga. s/s die-stamped pan with 3/4" dia. open drain and fully insulated; refrigeration coils bonded to underside in mastic - refrigeration system to be a hermetically sealed compressor operating on r-507 (hfc) refrigerant; dry-moist electric heat with (500 watt @208) heat source and individual solid state digital controls; all switches and controls are fully accessible.
7. Sneezeguard with heat lamp
8. Exterior receptacles - NEMA 6-20R (For item 084 Open Air Refrigerated Display)
9. Stainless steel legs
10. Bullet Feet, stainless steel
11. 18/304 removable front and exposed side toe kick
12. NSF
13. Wired to load center
14. With water fill hose

15. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 090c - PIZZA SERVING COUNTERS (2 REQ'D)
Low Temp Industries Model CUSTOM
Hot pizza serving counter/ display as follows:

1. Solid surface top
2. Square edge top
3. 18/304 cabinet with wood and standard grade laminate; front and exposed sides faced with 3/4"

plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Flex-serve sneezeguards model VGCP9-2C-LT-Tall with heat lamps
5. Stainless steel legs
6. Bullet Feet, stainless steel
7. 18/304 removable front and exposed side toe kick
8. Two-section heated product holding below
9. NSF
10. Wired to load center
11. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 090d - 2-TIER HEATED FOOD SERVING COUNTERS (2 REQ'D)
Low Temp Industries Model CUSTOM
Two tier heated display counter, as follows:

1. Solid surface top
2. Square edge top
3. 18/304 cabinet with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Enclosed rear cabinet with hinged door access
5. Two tier heated display shelves
6. Sneeze guards with lights
7. 18/304 s/s shelves (where necessary) sectional and removable.
8. Stainless steel legs
9. Bullet Feet, stainless steel
10. 18/304 removable front and exposed side toe kick
11. NSF
12. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 090e - HEATED DISPLAY COUNTERS (2 REQ'D)
Low Temp Industries Model CUSTOM
Heated display counter, as follows:

1. Solid surface top
2. Square edge top
3. 18/304 cabinet with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Enclosed rear cabinet with hinged door mechanical access; doors 18/304 s/s double pan and insulated.
5. 18/304 s/s shelves (where necessary) sectional and removable.
6. Interior receptacles - NEMA L14-20R (For item 085 Heated Display Merchandiser); provide 3" grommet in top for cord drop.
7. Stainless steel legs
8 Bullet Feet, stainless steel

9. 18/304 removable front and exposed side toe kick
10. NSF
11. Electrical load center
14. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 090f - COLD FOOD SERVING COUNTERS (2 REQ'D)
Low Temp Industries Model CUSTOM
Cold food serving counter with two-tier cold display as follows:

1. Solid surface top
2. Square edge top
3. 18/304 cabinet with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Enclosed rear cabinet with hinged door mechanical access; doors 18/304 s/s double pan and insulated.
5. 18/304 s/s shelves (where necessary) sectional and removable.
6. Two-tier cold shelves - Lower tier (1) Tempest air recessed cold pan - (3) pan wide with 1" open drain and shut off valve; Upper tier (1) 14/304 s/s frost top.
7. Air-cooled, hermetically sealed condenser mounted on 18 ga. s/s channel base; 18 ga. s/s removable louvered access panels; units sized as required.
8. Sneezeguard with lights
9. Stainless steel legs
10. Bullet Feet, stainless steel
11. 18/304 removable front and exposed side toe kick
12. NSF
13. Wired to load center
14. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 090g - CASHIER COUNTERS (2 REQ'D)
Low Temp Industries Model CUSTOM
Cashier counters as follows:

1. Solid surface top
2. Square edge top
3. 18/304 cabinet with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Cashier liner and footrest.
5. Cash drawer with lock.
6. Interior receptacles - NEMA 5-15R for POS Register; provide 3" grommet in top for cord drop.
7. Stainless steel legs
8. Bullet Feet, stainless steel
9. 18/304 removable front and exposed side toe kick
10. NSF
11. Wired to load center

12. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 090h - S/S TRAY SLIDES (1 lt REQ'D)
Low Temp Industries Model CUSTOM
1 lot stainless steel tray slides, as follows:

1. Solid surface tray rail with 3/4" thick plywood sub-top
2. 11” wide
3. 1-1/2” drop edge on all exposed edges
4. Three (3) embedded s/s rails
5. Mount on s/s fixed brackets
6. Provide with under-mount LED lighting
7. NSF
8. See sheet FS501.1 in Foodservice set for details.

Solid Surface Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 091a - TRAY STANDS (2 REQ'D)
Low Temp Industries Model CUSTOM
Tray stand, as follows:

1. 14/304 stainless steel top and sides
2. Square edge top
3. 14/304 side angles, 2" high
4. Four (4) 5" Polymer casters; two (2) fixed casters in the front, two (2) swivel casters with brakes at the rear.
6. Type 304 stainless steel handle
7. NSF

ITEM 091b - HOT/ COLD FOOD CONVERTIBLE SERVING COUNTERS (2 REQ'D)
Low Temp Industries Model CUSTOM
Hot/ cold food serving counter with four(4) individual quickswitch hot/cold wells, all glass adjustable sneezeguard, two-tier heated ceramic shelves as follows:

1. Solid surface top
2. Square edge top
3. 18/304 cabinet with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Enclosed rear cabinet with hinged door mechanical access; doors 18/304 s/s double pan and insulated.
5. 18/304 s/s shelves (where necessary) sectional and removable.
6. Two (2) sets of two (2) quickswitch wells - 18 ga. s/s die-stamped pan with 3/4" dia. open drain and fully insulated; refrigeration coils bonded to underside in mastic - refrigeration system to be a hermetically sealed compressor operating on r-507 (hfc) refrigerant; dry-moist electric heat with (500 watt @208) heat source and individual solid state digital controls; all switches and controls are fully accessible.
7. Sneezeguard with heat lamp

8. Exterior receptacles - NEMA 6-20R (For item 084 Open Air Refrigerated Display)
9. Stainless steel legs
10. Bullet Feet, stainless steel
11. 18/304 removable front and exposed side toe kick
12. NSF
13. Wired to load center
14. With water fill hose

15. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 091c - PIZZA SERVING COUNTERS (2 REQ'D)
Low Temp Industries Model CUSTOM
Hot pizza serving counter/ display as follows:

1. Solid surface top
2. Square edge top
3. 18/304 cabinet with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Flex-serve sneezeguards model VGCP9-2C-LT-Tall with heat lamps
5. Stainless steel legs
6. Bullet Feet, stainless steel
7. 18/304 removable front and exposed side toe kick
8. Two-section heated product holding below
9. NSF
10. Wired to load center
11. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 091d - 2-TIER HEATED FOOD SERVING COUNTERS (2 REQ'D)
Low Temp Industries Model CUSTOM
Two tier heated display counter, as follows:

1. Solid surface top
2. Square edge top
3. 18/304 cabinet with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Enclosed rear cabinet with hinged door access
5. Two tier heated display shelves
6. Sneeze guards with lights
7. 18/304 s/s shelves (where necessary) sectional and removable.
8. Stainless steel legs
9. Bullet Feet, stainless steel
10. 18/304 removable front and exposed side toe kick
11. NSF
12. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 091e - HEATED DISPLAY COUNTERS (2 REQ'D)
Low Temp Industries Model CUSTOM
Heated display counter, as follows:

1. Solid surface top
2. Square edge top
3. 18/304 cabinet with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Enclosed rear cabinet with hinged door mechanical access; doors 18/304 s/s double pan and insulated.
5. 18/304 s/s shelves (where necessary) sectional and removable.
6. Interior receptacles - NEMA L14-20R (For item 085 Heated Display Merchandiser); provide 3" grommet in top for cord drop.
7. Stainless steel legs
8 Bullet Feet, stainless steel
9. 18/304 removable front and exposed side toe kick
10. NSF
11. Electrical load center
14. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 091f - COLD FOOD SERVING COUNTERS (2 REQ'D)
Low Temp Industries Model CUSTOM
Cold food serving counter with two-tier cold display as follows:

1. Solid surface top
2. Square edge top
3. 18/304 cabinet with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Enclosed rear cabinet with hinged door mechanical access; doors 18/304 s/s double pan and insulated.
5. 18/304 s/s shelves (where necessary) sectional and removable.
6. Two-tier cold shelves - Lower tier (1) Tempest air recessed cold pan - (3) pan wide with 1" open drain and shut off valve; Upper tier (1) 14/304 s/s frost top.
7. Air-cooled, hermetically sealed condenser mounted on 18 ga. s/s channel base; 18 ga. s/s removable louvered access panels; units sized as required.
8. Sneezeguard with lights
9. Stainless steel legs
10. Bullet Feet, stainless steel
11. 18/304 removable front and exposed side toe kick
12. NSF
13. Wired to load center
14. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 091g - CASHIER COUNTERS (2 REQ'D)
Low Temp Industries Model CUSTOM
Cashier counters as follows:

1. Solid surface top
2. Square edge top
3. 18/304 cabinet with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Cashier liner and footrest.
5. Cash drawer with lock.
6. Interior receptacles - NEMA 5-15R for POS Register; provide 3" grommet in top for cord drop.
7. Stainless steel legs
8. Bullet Feet, stainless steel
9. 18/304 removable front and exposed side toe kick
10. NSF
11. Wired to load center
12. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 091h - S/S TRAY SLIDES (1 lt REQ'D)
Low Temp Industries Model CUSTOM
1 lot stainless steel tray slides, as follows:

1. Solid surface tray rail with 3/4" thick plywood sub-top
2. 11” wide
3. 1-1/2” drop edge on all exposed edges
4. Three (3) embedded s/s rails
5. Mount on s/s fixed brackets
6. Provide with under-mount LED lighting
7. NSF
8. See sheet FS501.1 in Foodservice set for details.

Solid Surface Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 092a - TRAY STANDS (2 REQ'D)
Low Temp Industries Model CUSTOM
Tray stand, as follows:

1. 14/304 stainless steel top and sides
2. Square edge top
3. 14/304 side angles, 2" high
4. Four (4) 5" Polymer casters; two (2) fixed casters in the front, two (2) swivel casters with brakes at the rear.

6. Type 304 stainless steel handle
7. NSF

ITEM 092b - HOT/ COLD FOOD CONVERTIBLE SERVING COUNTER (1 REQ'D)
Low Temp Industries Model CUSTOM
Hot/ Cold food serving counter, as follows:

1. Solid surface top
2. Square edge top
3. 18/304 counter with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Two-tier heated display shelves
5. Two-tier cold shelves - Lower tier (1) Tempest air recessed cold pan - (3) pan wide with 1" open drain and shut off valve; Upper tier (1) 14/304 s/s frost top.
6. Air-cooled, hermetically sealed condenser mounted on 18 ga. s/s channel base; 18 ga. s/s removable louvered access panels; units sized as required.
7. Sneezeguard with lights
8. 18/304 s/s shelves (where necessary) sectional and removable.
9. Stainless steel legs
10. Bullet Feet, stainless steel
11. 18/304 removable front and exposed side toe kick
12. NSF
13. Wired to load center
14. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 092c - DRY FOOD SERVING COUNTER (1 REQ'D)
Low Temp Industries Model CUSTOM
Dry food serving counter, as follows:

1. Solid surface top
2. Square edge top
3. 18/304 counter with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Enclosed rear cabinet with hinged door access
5. Stainless steel legs
6. Bullet Feet, stainless steel
7. 18/304 removable front and exposed side toe kick
8. NSF
9. Electrical load center
10. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 092d - HOT/ COLD FOOD SERVING COUNTER (1 REQ'D)
Low Temp Industries Model CUSTOM
Hot/ cold food serving counter with four(4) individual quickswitch hot/cold wells, all glass adjustable sneezeguard, two-tier heated ceramic shelves as follows:

1. Solid surface top
2. Square edge top
3. 18/304 counter with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Enclosed rear cabinet with hinged door mechanical access; doors 18/304 s/s double pan and insulated.
5. 18/304 s/s shelves (where necessary) sectional and removable.
6. Two (2) sets of two (2) quickswitch wells - 18 ga. s/s die-stamped pan with 3/4" dia. open drain and fully insulated; refrigeration coils bonded to underside in mastic - refrigeration system to be a hermetically sealed compressor operating on r-507 (hfc) refrigerant; dry-moist electric heat with (500 watt @208) heat source and individual solid state digital controls; all switches and controls are fully accessible.
7. Sneezeguard with heat lamp
8. Exterior receptacles - NEMA 6-20R (For item 084 Open Air Refrigerated Display)
9. Stainless steel legs
10. Bullet Feet, stainless steel
11. 18/304 removable front and exposed side toe kick
12. NSF
13. Wired to load center
14. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 092e - DRY FOOD SERVING COUNTER (1 REQ'D)
Low Temp Industries Model CUSTOM
Dry food serving counter, as follows:

1. Solid surface top
2. Square edge top
3. 18/304 counter with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Enclosed rear cabinet with hinged door access
5. N/A
6. Stainless steel legs
7. Bullet Feet, stainless steel
8. 18/304 removable front and exposed side toe kick
9. NSF
13. Electrical load center
14. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 092f - CASHIER COUNTERS (1 REQ'D)
Low Temp Industries Model CUSTOM
Cashier counters as follows:

1. Solid surface top
2. Square edge top

3. 18/304 counter with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Cashier liner and foot rest.
5. Cash drawer with lock.
6. Interior receptacles - NEMA 5-15R for POS Register; provide 3" grommet in top for cord drop.
7. Stainless steel legs
8. Bullet Feet, stainless steel
9. 18/304 removable front and exposed side toe kick
10. NSF
11. Wired to load center
12. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 092g - S/S TRAY SLIDES (1 lt REQ'D)
Low Temp Industries Model CUSTOM
1 lot stainless steel tray slides, as follows:

1. Solid surface tray rail with 3/4" thick plywood sub-top
2. 11” wide
3. 1-1/2” drop edge on all exposed edges
4. Three (3) embedded s/s rails
5. Mount on s/s fixed brackets
6. Provide with under-mount LED lighting
7. NSF
8. See sheet FS501.1 in Foodservice set for details.

Solid Surface Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 093a - TRAY STANDS (2 REQ'D)
Low Temp Industries Model CUSTOM
Tray stand, as follows:

1. 14/304 stainless steel top and sides
2. Square edge top
3. 14/304 side angles, 2" high
4. Four (4) 5" Polymer casters; two (2) fixed casters in the front, two (2) swivel casters with brakes at the rear.
6. Type 304 stainless steel handle
7. NSF

ITEM 093b - HOT/ COLD FOOD CONVERTIBLE SERVING COUNTER (1 REQ'D)
Low Temp Industries Model CUSTOM
Hot/ Cold food serving counter, as follows:

1. Solid surface top
2. Square edge top
3. 18/304 counter with wood and standard grade laminate; front and exposed sides faced with 3/4"

plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Two-tier heated display shelves
5. Two-tier cold shelves - Lower tier (1) Tempest air recessed cold pan - (3) pan wide with 1" open drain and shut off valve; Upper tier (1) 14/304 s/s frost top.
6. Air-cooled, hermetically sealed condenser mounted on 18 ga. s/s channel base; 18 ga. s/s removable louvered access panels; units sized as required.
7. Sneezeguard with lights
8. 18/304 s/s shelves (where necessary) sectional and removable.
9. Stainless steel legs
10. Bullet Feet, stainless steel
11. 18/304 removable front and exposed side toe kick
12. NSF
13. Wired to load center
14. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 093c - DRY FOOD SERVING COUNTER (1 REQ'D)
Low Temp Industries Model CUSTOM
Dry food serving counter, as follows:

1. Solid surface top
2. Square edge top
3. 18/304 counter with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Enclosed rear cabinet with hinged door access
5. Stainless steel legs
6. Bullet Feet, stainless steel
7. 18/304 removable front and exposed side toe kick
8. NSF
9. Electrical load center
10. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 093d - HOT/ COLD FOOD SERVING COUNTER (1 REQ'D)
Low Temp Industries Model CUSTOM
Hot/ cold food serving counter with four(4) individual quickswitch hot/cold wells, all glass adjustable sneezeguard, two-tier heated ceramic shelves as follows:

1. Solid surface top
2. Square edge top
3. 18/304 counter with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Enclosed rear cabinet with hinged door mechanical access; doors 18/304 s/s double pan and insulated.
5. 18/304 s/s shelves (where necessary) sectional and removable.

6. Two (2) sets of two (2) quickswitch wells - 18 ga. s/s die-stamped pan with 3/4" dia. open drain and fully insulated; refrigeration coils bonded to underside in mastic - refrigeration system to be a hermetically sealed compressor operating on r-507 (hfc) refrigerant; dry-moist electric heat with (500 watt @208) heat source and individual solid state digital controls; all switches and controls are fully accessible.
7. Sneezeguard with heat lamp
8. Exterior receptacles - NEMA 6-20R (For item 084 Open Air Refrigerated Display)
9. Stainless steel legs
10. Bullet Feet, stainless steel
11. 18/304 removable front and exposed side toe kick
12. NSF
13. Wired to load center
14. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 093e - DRY FOOD SERVING COUNTER (1 REQ'D)
Low Temp Industries Model CUSTOM
Dry food serving counter, as follows:

1. Solid surface top
2. Square edge top
3. 18/304 counter with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Enclosed rear cabinet with hinged door access
5. N/A
6. Stainless steel legs
7. Bullet Feet, stainless steel
8. 18/304 removable front and exposed side toe kick
9. NSF
13. Electrical load center
14. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 093f - CASHIER COUNTERS (1 REQ'D)
Low Temp Industries Model CUSTOM
Cashier counters as follows:

1. Solid surface top
2. Square edge top
3. 18/304 counter with wood and standard grade laminate; front and exposed sides faced with 3/4" plywood covered with standard grade laminate plastic; 18 ga. stainless steel rear, unexposed ends and partitions.
4. Cashier liner and foot rest.
5. Cash drawer with lock.
6. Interior receptacles - NEMA 5-15R for POS Register; provide 3" grommet in top for cord drop.
7. Stainless steel legs
8. Bullet Feet, stainless steel
9. 18/304 removable front and exposed side toe kick

10. NSF
11. Wired to load center
12. See sheet FS501.1 in Foodservice set for details.

Solid Surface and Laminate Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 093g - S/S TRAY SLIDES (1 lt REQ'D)
Low Temp Industries Model CUSTOM
1 lot stainless steel tray slides, as follows:

1. Solid surface tray rail with 3/4" thick plywood sub-top
2. 11” wide
3. 1-1/2” drop edge on all exposed edges
4. Three (3) embedded s/s rails
5. Mount on s/s fixed brackets
6. Provide with under-mount LED lighting
7. NSF
8. See sheet FS501.1 in Foodservice set for details.

Solid Surface Selection: Formica/WilsonArt finish TBD. KES to coordinate final finish Interior Design sheets and specifications.

ITEM 094 - POINTS OF SALE (10 REQ'D)
Owner provided Model -
Points of sale, provided by Owner. Data required. Plug into cashier counters.

ITEM 095 - ICE MAKER (1 REQ'D)
Manitowoc Model IYT0420A
Indigo NXT™ Series Ice Maker, cube-style, air-cooled, self-contained condenser, 22"W x 24-1/2"D x 21-1/2"H, production capacity up to 460 lb/24 hours at 70°/50° (375 lb AHRI certified at 90°/70°), DuraTech™ exterior, half-dice size cubes, R410A refrigerant, NSF, cULus, CE, ENERGY STAR®
1 ea (-161) 115v/60/1-ph, 11.3 amps
1 ea Model WARRANTY-ICE-SC 3 year parts & labor (Machine), 5 year parts & labor (Evaporator), 5 year parts & 3 years labor (Compressor), standard
1 ea Everpure Model EV932422 Insurice Twin PF-i2000² Twin System, 18,000 gallon capacity, 3.34 gpm flow rate, 0.5-micron precoat filtration, (2) I2000² cartridges, with self-contained scale inhibitor feed, (1) EC210 sediment prefilter Cartridge, for cubers up to 1,450 lbs/day or flakers up to 2,200 lbs/day, pressure gauge, flushing valve, NSF, ANSI

ITEM 096 - ICE AND WATER DISPENSER (1 REQ'D)
Multiplex Model S-150
S-150 Ice Dispenser, countertop, 150 lbs. ice capacity, sanitary lever dispense, includes "Ice" graphics, drain kit, leg kit, cUL, UL, NSF, Made in USA
1 ea Sanitary Lever
1 ea Water Valve - Flomatic 202 Sanitary Lever, modular design, quiet solenoid operation, field convertible, molded plastic, NSF
1 ea Model 020000245 SL26 Strip Lid Assembly, for use with 22" Manitowoc cuber & nugget or 22" non-Manitowoc ice machines mounted on SV-150 dispensers

1 ea ADA compliance kit
1 ea 2 year limited parts & 1 year limited labor warranty (USA)

ITEM 097-101 - SPARE NO. <Spare No.>

ITEM 102 - S/S SERVING TABLES (4 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Work Table, size and shape per plan, 35" high, no backsplash as follows:

1. 14/304 stainless steel top
2. Square edge table
3. 16/304 series stainless steel undershelf with marine edge
4. 1-1/2" rear upturn for undershelf
5. All welded construction, legs, undershelf and top
6. Stainless steel legs
7. Casters, set of (6), 4" diameter, (3) swivel & (3) swivel/brake, 115 lbs. capacity per caster, zinc with resilient tread, NSF

NOTE: All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

ITEM 103 - SINGLE SECTION REACH-IN REFRIGERATORS (4 REQ'D)
Continental Refrigerator Model D1RNSS Dimensions: 83.25(h) x 26(w) x 35.38(d)
Designer Line Refrigerator, reach-in, one-section, 21 cu. ft., self-contained refrigeration, stainless steel exterior & interior, standard depth cabinet, full-height solid door, cylinder lock, electronic control with digital display, hi-low alarm, unit comes standard with expansion valve, 6" stainless steel legs, R290 hydrocarbon refrigerant, 1/4 HP, cETLus, NSF, ENERGY STAR®
4 ea 115v/60/1-ph, 5.2 amps, cord, NEMA 5-15P, standard
4 ea Hinging as per plan
4 st Model 50177-4 Casters, swivel, with brakes (5" diameter rubber tires) set of 4 (6" height)
4 ea Standard warranty (for the United States & Canada Only): 3 year parts and labor; additional 4 year compressor part

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ITEM 104 - HEATED CABINETS (4 REQ'D)
Alto-Shaam Model 1200-UP
Halo Heat® Holding Cabinet, double compartment, on/off simple controller with adjustable thermostats, indicator light, (2) sets of chrome plated universal side rails, (4) sets of pan slides, (16) 20" x 12" x 2-1/2" full size pan capacity, heavy stainless steel exterior, 5" casters; 2 rigid, 2 swivel with brakes, EcoSmart®, cULus, UL EPH ANSI/NSF 4, CE, IPX4, TUV NORD, EAC
4 ea 120v/60/1-ph, 16.0 amps, 1.9kW, 9' cord, NEMA 5-20P
4 ea Cres Cor Hinging as per plan
4 ea Model SR-24762 Universal Pan Slide, stainless steel (2 pieces required)

NOTE: See sheet FS101 for door hinging orientations

ITEM 105 - MILK COOLERS (2 REQ'D)
Continental Refrigerator Model MC5NSSD Dimensions: 47(h) x 58(w) x 33(d)

Milk Cooler, 58" long, dual access, forced air cooling, (16) 13" x 13" x 11" or (10) 19" x 13" x 11" crate capacity, door cylinder security locks, electronic control with digital display, hi-low alarm, hi/low temperature alarm, stainless steel interior & exterior, floor drain, (4) 5" swivel casters with front locking brakes, R290 Hydrocarbon refrigerant, 1/4 HP, cETLus, NSF

2 ea Standard warranty (for the United States & Canada Only): 3 year parts and labor; additional 4 year compressor part

2 ea 115v/60/1-ph, 7.6 amps, cord, NEMA 5-15P, standard

ITEM 106 - REMOTE SERVERY GENERAL STORAGE SHELVING (2 REQ'D)
Metro Model VARIES
Remote servery storage shelving (5 tier) consisting of the following:

10 ea Model 2448BR Super Erecta® Shelf, wire, 48"W x 24"D, Brite (zinc) finish, plastic split sleeves are included in each carton, NSF

8 ea Model 74UP Super Erecta® Post, 73-7/8"H, for use with stem casters, chrome plated finish

8 ea Model 5MB Super Erecta® Stem Caster, swivel (with foot operated brake), 5" dia., 1-1/4" face, 200 lb. capacity, resilient rubber flat wheel tread, includes bumper

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ITEM 107 - 48" AIR CURTAIN FANS (2 REQ'D)
Berner Model PE06-C-1048A
Pass Thru Unit 6 Ambient (Unheated) Air Curtain, 48"L, unheated, (1) 1/5HP Variable Speed Motor, for openings up to 6' high, baked-on electrostatic powder coated aluminized steel cabinet, interior/exterior mounting, UL Outdoor, Made in the USA

2 ea 120v/60/1-ph, standard

2 ea Model 33V006S-DS-AK Remote Mounted Rheostat Variable Speed Switch, Suitable for controlling (1) motor Voltage Code A = 120/1/60, Switch must be mounted indoors only

2 ea Model 91EZN120-BA-M-120 Basic Control Package, NEMA 4 Mag Reed, 120V only, includes RIB Relay

2 ea Stainless steel exterior finish, add sufix "SS" to model no. (contact factory for lead time) $103 per linear foot

2 ea 5 year parts warranty (unheated units), standard

ITEM 108-110 - SPARE NO. <Spare No.>

ITEM 111 - ROLL-IN REFRIGERATORS (2 REQ'D)
Continental Refrigerator Model D1RINSS Dimensions: 86(h) x 35.25(w) x 35.38(d)
Designer Line Refrigerator, roll-in, one-section, self-contained refrigeration, stainless steel exterior & interior, standard depth cabinet, full-height solid door, cylinder lock, electronic control with digital display, hi-low alarm, unit comes standard with expansion valve, R290 hydrocarbon refrigerant, removable stainless steel ramp, 1/4 HP, ENERGY STAR®, cETLus, NSF

2 ea 115v/60/1-ph, 6.3 amps, cord & plug, standard

2 ea Door hinging per plan

2 ea Standard warranty (for the United States & Canada Only): 3 year parts and labor; additional 4 year compressor part

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ITEM 112 - VENTLESS CONVEYOR PIZZA OVENS (2 REQ'D)
Ovention Model CONVEYOR C2000
C2000 Precision Impingement Conveyor Oven, ventless, rapid cook, countertop, 20” wide belt, 21" cook chamber, touch screen display, built-in self-diagnostics, USB menu upload, smart voltage sensor

technology, cool to touch 430 stainless steel exterior, 304 stainless steel interior, 4" adjustable legs, cULus, UL EPH, Made in USA
2 ea Model C2000-3S 208-240v/60/3-ph, 34.0 amps, 16.3kW, cULus, cord & NEMA 15-50P, standard
2 ea (1) Year parts & labor warranty, standard
2 ea Front mounted touchscreen control - standard

ITEM 113 - S/S PIZZA TABLES (2 REQ'D)
Florida Stainless Fabricators Model CUSTOM
Pizza Table, size and shape per plan, 35" high, no backsplash as follows:

1. 14/304 stainless steel top
2. Square edge table
3. 16/304 series stainless steel undershelf with marine edge
4. 1-1/2" rear upturn for undershelf
5. All welded construction, legs, undershelf and top
6. Stainless steel legs
7. Casters, set of (6), 4" diameter, (3) swivel & (3) swivel/brake, 115 lbs. capacity per caster, zinc with resilient tread, NSF

NOTE: All materials, gauges, finishes and construction shall be in accordance with the Part 2.1 of Section 11 40 00 Specifications.

ITEM 114 - ROLL-IN HEATED CABINETS (2 REQ'D)
Continental Refrigerator Model DL1WI-SS Dimensions: 86(h) x 35.25(w) x 35.38(d)
Designer Line Warmer, roll-in, one-section, stainless steel exterior & interior, standard depth cabinet, full-height solid door, electronic control with digital display, hi-low alarm, cETLus, NSF
2 ea 208-230v/60/1, 7.4 amps, cord & plug supplied by others
2 ea Door hinging per plan
2 ea Standard warranty (for the United States & Canada Only): 3 year parts and labor

NOTE: EC TO PROVIDE CORD AND PLUG

ITEM 115-120 - SPARE NO. <Spare No.>

ITEM 500 - UTILITY SINK (1 REQ'D) <By G/C>
General Contractor Model -
Utility sink and faucet, provided and installed by GC. See A/E Plumbing sheets for details.

ITEM 501- SPARE NO. <Spare No.>

ITEM 502 - WASHER AND DRYER (1 REQ'D)
Owner provided Model -
Washer and dryer, provided by Owner, installed by GC. See A/E Electrical and Plumbing sheets for details.

ITEM 503-504 - SPARE NO. <Spare No.>

ITEM 505 - LINEN SHELVING UNIT (1 REQ'D)
Metro Model -
Linen shelving unit (5 tier) consisting of the following:

5 ea	Model 2436NK3 Super Erecta® Shelf, wire, 36"W x 24"D, plastic split sleeves are included in each carton, Metroseal 3™ epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, NSF
4 ea	Model 74UPK3 Super Erecta® SiteSelect™ Post, 74"H, for use with stem casters, Metroseal 3™ epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection
4 ea	Model 5MB Super Erecta® Stem Caster, brake (foot operated), 5" diameter, 1-1/4" face, resilient wheel tread, 200 lb. capacity, brakes are foot operated

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ITEM 506 - LOCKERS (1 lt REQ'D)
General Contractor Model -
Lockers, 12" wide x 2 high, provided and installed by GC. See Division 10 for specification.

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ITEM 507 - S/S CORNER GUARDS (32 REQ'D)
General Contractor
14/304 stainless steel corner guards consisting of the following:

Twenty-eight (28) corner guards, 2"x 2" x 54"L
Four (4) corner guards, 2"x 2" x 114" (at the walk-in wall openings)

Provided and installed by GC.

NOTE: All materials, gauges, finishes and construction shall be in accordance with the Section 11 40 00, Part 2.1 Food Service Specifications. Any/all questions of clarification of materials or fabrication methods must be addressed in writing prior to bidding.

END OF SECTION 11 40 00

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SECTION 11 52 13
PROJECTION SCREENS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Projection Screens.

1.3 SUBMITTALS

A. Product Data: For projection screens indicated.

B. Shop Drawings: For projection screens. Show layouts and types of projection screens. Include the following:

1. For electrically operated projection screens and controls:

a. Location of screen centerline relative to ends of screen case.
b. Location of wiring connections for electrically operated units.
c. Location of seams in viewing surfaces.
d. Drop lengths.
e. Anchorage details, including connection to supporting structure for suspended units.
f. Details of juncture of exposed surfaces with adjacent finishes.
g. Accessories.
h. Wiring diagrams.

C. Samples: For finishes of surface-mounted screen cases.

D. Maintenance Data: For projection screens.

1.4 QUALITY ASSURANCE

A. Source Limitations for Projection Screens: Obtain projection screens from single manufacturer. Obtain accessories, including necessary mounting hardware, from screen manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install projection screens until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.6 COORDINATION

A. Coordinate layout and installation of projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, fire-suppression system, and partitions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Product and Manufacturer; Da-Lite Screen Company, Inc. Model B 52” x 92” Projector Screen (HDTV) - 78670 - - (cdwg.com), or subject to com

2.2 ROLLERS

A. Provide rigid metal spring rollers for operation of manual screens. Fabricate from either steel or aluminum. Material and roller diameter determined by manufacturer as required by type and size of manual screen.

2.3 VIEWING SURFACE

A. Flame retardant, mildew resistant, white, vinyl coated fiberglass screen that can be rolled and cleaned with mild soap and water solution.

1. Gain: 1.0
2. Viewing angle: 50 degrees

B. Seams: To the extent possible screen surfaces shall be seamless. Where required by size, provide a minimum number of flat, horizontal seams. Vertical seams are not acceptable.

2.4 MANUALLY OPERATED PROJECTION SCREENS (Provide one at each teaching wall as indicated on the drawings)

A. Model B is to be installed with 6 inch non-adjustable extension brackets.

B. Installation method: Wall mounted with 6 inch non-adjustable extension brackets.

C. Case: 22 gauge octagonal steel case with flat back and steel end caps with roller supports, wall mounting brackets and ceiling hanger rings.

1. Case length: 100 inches

2. Finish: White enamel paint

D. Attach screen fabric to roller with metal strip crimped to fabric and inserted in camloc device on roller. Screen shall be removable for replacement bur prevented from pulling out from roller. Use of tape, glue, staples and cords is not acceptable. Mount fabric bottom to metal strip in tubular steel slat. Protect slat ends with plastic caps. Screw attach zinc plated pull to slat.

E. Viewing surface: Matte White

1. Size: 52 inches high by 92 inches wide
2. Provide with black masking borders.

2.5 POWER OPERATED PROJECTION SCREENS (Auditorium/ Stage)

A. Envoy model is to be installed.

B. Installation method: Ceiling mount in recessed case.

C. Case – Fully enclosed, recessed case with full length continuous hinge mounted bottom.

D. Screen type – matte white, black masking border, flame retardant and mildew resistant. Size – 20’-0” H x 20’-0” W.

E. Provide key type switch; indicating up and down.

2.6 ACCESSORIES

A. Installation hardware: Provide attachment hardware, fasteners and other components of type, size and spacing recommended by manufacturer for complete, functional, secure installation of manual screens.

B. Tilt lock: Provide manual screens with tilt lock to hold screen in tilted backward position to eliminate keystoning. Device to consist of removable hook magnetically attached to metal mounting plate adhered to wall with adhesive.

C. Pull rods: Provide manual screens with zinc-plated rod with black plastic handle grip to access and operate out of reach screens. Rod shall be suitable for use as pointer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate locations and preparation of openings in ceiling at recessed locations. Verify mounting heights with ARCHITECT.

B. Install front-projection screens at locations indicated to comply with screen manufacturer's written instructions.

C. Power Projection Screen installations shall be adjusted to meet the requirements of the ceiling height and physical location in the room.

D. Set level and secure brackets firmly to wall and/or ceiling to withstand frequent operation without bind or failure. Ceiling mounted screens are not to be supported from ceiling system, but through ceiling to overhead structure.

E. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.

1. Install low-voltage controls according to NFPA 70 and complying with manufacturer's written instructions.

    a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

2. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.

3. Protect from damage by surrounding construction operations until final acceptance by OWNER.

END OF SECTION 11 52 13

SECTION 11 53 00
SCIENCE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work of this Section includes the following:

1. Science Equipment

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of fixture or piece of equipment.

1.4 QUALITY ASSURANCE

A. Contractor Qualifications: Employ only experienced Contractors (Installers) skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five (5) years.

B. Manufacturer Qualifications: Employ only manufacturers with at least five (5) years experience making the specified materials as a current catalog and regular production item.

C. Flammable Liquid Storage: Provide cabinets units for solvent or flammable liquid storage that are listed and labeled as complying with requirements of NFPA 30.

D. Source Limitations: To the extent possible, obtain science equipment through one source from a single manufacturer.

1.5 WARRANTY

A. Project Warranty shall be as stated in Division 01 of the Specifications.

B. Manufacturer's Warranty

1. Science Equipment shall be warranted against manufacturing defects in material and fabrication for a period of one (1) year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SAFETY GLASSES CABINET

A. Basis of Design Product and Manufacturer; as indicated.

B. Cabinet: Comply with the following:

1. Size: 24-5/8 inches L x 12 inches W x 25-1/8 inches H.
2. Provide high gloss steel cabinet with steel interior with capacity for 36 pairs of goggles.
3. Cabinet shall include an automatic timer control and two germicidal lamps.
4. Locks shall be provided.

2.2 FLAMMABLE STORAGE CABINET

A. Basis of Design: #25100 as manufactured by Sheldon Laboratory Systems.

B. Cabinet: Comply with the following:

1. Size: 43 inches L x 18 inches D x 65 inches H.
2. Cabinet shall have double wall construction throughout with 1 ½ inches insulating air space between inner and outer walls.
3. Provide hinged doors with 3 point latch and lock, two adjustable shelves of reinforced galvanized steel, 2 inches deep pan bottom, screened flame arrestor vent on each side and threaded to accept 2 inches standard pipe.
4. Finish shall be bright safety yellow and labeled in red “Flammable Liquid – Keep Fire Away.”
5. Cabinets shall comply with NFPA Code 30 and LSHA safety requirements.
6. Capacity: Not less than 45 Gallons.
7. Shelves must have a ½” lip at leading edge.

2.3 CORROSIVE STORAGE CABINET

A. Basis of Design: Product and Manufacturer; Edsal SKU AC300A ACID STORAGE CABINET

1. Cabinet is constructed of 18 ga. Powder coated steel with acid resistance. Meets NFPA Code 30 and OSHA Standard 19100.106 for storage of Class, I, II and II liquids.

a. Capacity: 30 Gallons. 500 pounds.
b. Dimensions; 43-inches wide x 18-inches deep x 44-inches high.
c. Shelving; (2) shelves (1) fixed and (1) adjustable.
d. Labeling; “ACID” is printed on the cabinet in six-inch (6”) red letters.
e. Unit furnished with locking door handle.

2.4 DRYING RACKS (PEG BOARD)

A. Drying Racks shall be constructed of 1" Phenolic Resin with (40) white plastic pegs - 5" long and 3/8" diameter.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sheldon Laboratories; Model 79530, or approved equal.

    a. Size: 36" x 24".
    b. Provide Stainless Steel drip trough, Sheldon Model MET-511.

2.5 FIRE BLANKET AND CABINET

A. Cabinet shall be constructed of cold-rolled steel with red baked enamel finish. Cabinet shall be complete with nominal 62" x 80" fire-retardant blanket fabricated of blended reprocessed wool. Folded blanket shall be visible through the viewing knockout on the front and shall be quickly available by releasing hinged bottom of cabinet.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; Model FB 1016. or a comparable product by one of the following:

    a. Babcock-Davis.
    b. Nystrom, Inc.
    c. Potter Roemer LLC.

2.6 FIRST AID CABINET

A. Cabinet shall be Wall mounted unit is provided with two adjustable shelves. Doors are natural almond melamine with Red Cross applied on door fronts.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sheldon Laboratories; Model 66109, or approved equal.

    a. Size: 35” W. x 12” D. x 30 1/2” H.

2.7 AUTOCLAVE

A. Basis of Design Product and Manufacturer; Tuttnauer, 2540MK Kwiklave Autoclave.

B. Features:

1. Automatic shut off at the end of both the sterilization and dry cycles.
2. A long life electro- polished chamber and door.
3. Double safety locking device prevents door from opening while chamber is pressurized.
4. Drain valve is located on the front, allowing for quick and easy draining of water reservoir.
5. Dual safety thermostat to protect against overheating.
6. International certifications.

C. Specifications:

1. Chamber Dimensions: 10" x 19".
2. Chamber Volume: 6 gallons (23 L).
3. Overall Dimensions: 21.5" (D) x 20.0" (W) x 14.4" (H).
4. Standard Cassette capacity: 3 full and 3 half.
5. Tray Dimensions: 16.3" (D) x 6.7" (W) x 0 .8" (H).

6. Number of Trays: 4.
7. Standard Unwrapped Cycle Time:
8. Cold: 21 minutes.
9. Hot: 11 minutes.
10. Voltage: 2 30 V.
11. Frequency: 50/60 Hz.
12. Power: 2200 W.
13. Current: 10 A.
14. Shipping Weight: 85 lbs (39 kg).
15. Meets the following International Standards: PED 97/23, MOD 93/42, ASME, UL/EN 61010-1, FDA, ISO 13485:2003, ISO 9001:2000.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with the Manufacturers Recommendations.

END OF SECTION 11 53 00

SECTION 11 53 13
PORTABLE LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ductless Laboratory fume hoods.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For fume hood exterior finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Showing compliance with specified performance requirements for as-manufactured containment and static pressure loss, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency.

B. Source quality-control reports.

C. Field quality-control reports.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish complete touchup kit for each type and color of fume hood finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged fume hood finish.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.9 WARRANTY

A. The manufacturer shall guarantee all materials and workmanship provided for a period of one year from date of OWNER acceptance. Any defects due to the use of improper material or workmanship on the part of manufacturer occurring within that time shall be promptly rectified, by repair or replacement of the defective materials or correction of defective workmanship by manufacturer at his own expense, after notification by the OWNER.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Product and Manufacturer; Provide laboratory fume hoods manufactured or furnished by AireClean Systems Model ACTA48 Fume Hood, or approved equal.

B. Standard Features

1. Automatic safety controller.
2. Integral base with deep spill lip.
3. Clear polycarbonate shell for 360° visibility.
4. No ductwork required.
5. No installation required - plugs directly into a standard 110V or 220V electrical outlet.
6. Extremely quiet operation < 49dBA.
7. Gas phase bonded carbon filtration.
8. Lab event timer.
9. HEPA filtration for capture of particulate to 0.3 microns in size.

C. Safety Features

1. Brushless, sparkless blower is post-filter.
2. Deep base effectively contains accidental spills.
3. Filter and electronics are located above the workspace, eliminating the chance of a chemical spill entering these sensitive areas.
4. Filter safety lockout to ensure correct filter replacement.
5. Flame-retardant pre-filter.
6. Low airflow alarm warns the user both visually and audibly.
7. Real time monitoring of installed filtration bed.
8. Shipped fully assembled.

9. Tested to UL 61010-1,CSA C22.2 No. 61010-1, and EN 61326-1.

D. Accessories: Provide Rolling Cart from Fume Hood Manufacturer, for each Fume Hood.

1. Tube members: 1-1/2" 14 gauge steel.
2. Shall provide two-position moveable base bar for ADA accessibility.
3. Shall have locking caster.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fume hoods according to manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Field test each unit after completion of installation to verify proper operation of hoods in accordance with specified requirements.

3.4 ADJUSTING AND CLEANING

A. Moving Parts: Carefully check and adjust moving parts to insure smooth, near-silent, and accurate sash operation with one hand and with uniform contact of rubber bumpers; ensure counterbalances operate without interference.

B. Clean surfaces, including both sides of glass.

C. Damaged Work: Repair equal to new undamaged work, or replace with new units, as acceptable to Architect.

END OF SECTION 11 53 13

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SECTION 11 61 35
ORCHESTRA PIT FILLER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SCOPE

A. Intent: This specification covers the fabrication, furnishing, delivery, and installation of a complete Pit Filler System for the Auditorium Stage. The form of the contract, general conditions, and the project drawings are considered to be part of these specifications.

A. Definitions: For this project, the following entities are referenced:

1. Owner: St. Lucie County School Board
2. Architect: Schenkel Shultz Architects
3. Theatre Consultant: TSG Design Solutions, Inc. Now part of TLC

B. General: Provide all items and work necessary for complete, safe, fully functional systems as specified, including:

1. Tools, scaffolding, equipment, labor and supervision, even though they may not be specifically enumerated.
2. Verification of dimensions and conditions at the job site.
3. Coordination of the work of this section with stage rigging and lighting systems, and other building systems whether under this contract or performed under a separate, prime contract.
4. Notification to the Architect/Engineer of any conditions, measurements, quantities, or other data, as required for proper execution, fit and completion of all work, and for safe and proper operating clearances.
5. Shipment of equipment to job site and the secured storage of all non-fixed equipment.
6. Installation and completion, in accordance with these Specifications, related Drawings, the Equipment Manufacturer's recommendations, established trade criteria, and all applicable code requirements.
7. Inspection, demonstration, and necessary adjustment of the completed installation by the Contractor's installation personnel.
8. Preparation and submission of complete record drawings and operational and maintenance data and certificates.
9. A one-year inspection by the Contractor.

C. Errors and Omissions: Any errors, omissions, or ambiguities found in these documents do not relieve the Contractor of the responsibility of providing all items necessary for complete, safe, fully functional systems. Any errors, omissions, or ambiguities shall be brought to the attention of the Architect/Engineer of Record, Construction Manager, Owner, and/or Theater Consultant for clarification.

1.3 WORK INCLUDED:

A. Without restricting the volume or generality of the above scope of work to be performed under this section this section shall include, but not be limited to, the following.

1. Provide portable platforms that comprise the orchestra pit filler system in quantities and arrangements as shown in the contract drawings. Platforms shall be designed to work in a single configuration as a functioning platform system that is level at stage height.
2. The Installation Contractor shall provide for the demonstration of the setup and breakdown of the orchestra pit filler.
3. The Installation Contractor shall provide the systems manuals.
4. The Installation Contractor shall provide the systems warranty.

1.4 RELATED WORK NOT INCLUDED

A. The following related items of work, if required, are in other sections and shall not be included under this contract:

B. Structural steel and miscellaneous metals, head block beams, and loading bridges and railings.

C. Galleries, ladders and catwalks.

D. Lighting and electrical connections, conduit, junction boxes and wiring to power sources, to all other electrically powered devices listed in these specifications.

E. All modifications to the building steel required to support or to provide access to components.

1.5 GENERAL REQUIREMENTS

A. Field Conditions: This project is the provision and installation of new systems within a new venue. All bidders shall fully inform themselves of the conditions under which the work is to be performed. No additional compensation or time extension will be given for conditions of which the bidder could have been fully aware prior to bid.

B. Safety: The systems shall conform to all applicable code requirements and shall be provided and installed in conformance to industry standards of operation and practices. All materials, arrangements, and procedures shall comply with applicable code requirements, allowing the end user to arrange and operate a safe assembly and working environment for the audience and user's personnel.

C. Insurance: In the absence of more stringent requirements, the Contractor shall maintain sufficient injury and property liability insurance coverage throughout the project's scheduled timetable, including workmen's compensation coverage for the Contractor's employees.

1.6 CONTRACTOR'S QUALIFICATIONS

A. Only qualified contractors shall be used.

B. The work of this section will be contracted to a single firm, referred to as the contractor.

C. All equipment and installation shall be the responsibility of a single contractor who shall own and operate a full-time, staffed shop for the fabrication and/or assembly of stage equipment. This Contractor shall assume complete responsibility for the design, fabrication, transportation, and installation of the work in this Section, and shall hold the Owner, Architect, Theater Consultant, and all their Employees and Consultants harmless for any costs for errors or omissions associated with the work of this Section and any action arising there from.

D. The Contractor shall have at least ten (10) years' experience in the installation of similar equipment and systems for professional and educational theaters. If requested, the Contractor shall submit a representative list of professional theater installations.

E. The Contractor shall be a member in good standing of the Production Lighting and Sound Association (PLASA) and maintain qualifying membership for the duration of the project.

F. The contractor shall have maintained for the five years preceding the bid date, a suitably staffed and equipped service organization which has continuously offered maintenance and repair services for systems of the nature, size, scope and complexity to that contemplated by this specification.

G. The contractor shall maintain for the duration of this contract all required business and professional licenses and insurance.

H. The contractor shall demonstrate to the satisfaction of the owner, through submittals presented in accordance with the project timetable, that the contractor meets all the above qualifications. The minimum contractor qualification submittal shall include the following:

1. Statement of company history. Include a breakdown by percentage of gross sales of all business activities the contractor is involved in for each of the last 5 years (e.g., system installation = 30%, expendable sales = 40%, service = 20%, design and other professional services = 10%, etc.).
2. Previous experience: Provide a list of four installations (for tension wire grid a listing of10 equivalent installations are required) of the type and size contemplated by these specifications, currently in use as originally installed, in which a theatre / system consultant was involved, completed in the last 5 years and the following information regarding each installation:

    a. Name and address of each installation.
    b. Facility owner and telephone number.
    c. Name, address, and phone number of a person regularly employed by the owner, who is familiar with the operation of the systems and who has no connection or business connections with the contractor except as the contractor shall fully disclose
    d. Name, address, and phone number of the theatre or system consultant, along with the names of all the consultant’s personnel directly involved.
    e. System shop drawings. These will be returned if the contractor provides a call tag or return postage.
    f. Owner’s manual drawings - These will be returned if the contractor provides a call tag or return postage.
    g. System as-built drawings - These will be returned if the contractor provides a call tag or return postage.
    h. List of contractor’s personnel involved with each person’s responsibility on the project.
    i. Name, address and phone number of the general contractor, along with the names of all key GC personnel directly involved.
    j. Name address and phone number of the electrical contractor, along with the names of all key EC personnel directly involved.

3. Statement of current company capabilities and ownership.
4. Key Personnel. For each of the key personnel listed below; Include individual's name, title, and number of continuous years of service to contractor. Include a resume detailing industry experience, and role within organization (include only full-time/regular staff employees; not independent contractor, freelance, or temporary positions). List all industry certifications held, training courses attended, and continuing education credits, including dates of attendance. List recently completed projects, scope of project, and completion dates.
   a. Project Manager
   b. Senior Technician
   c. Service Manager
5. Other Department Staff. Include size of staff and experience of each staff member.
6. Replacement and Spare Parts Inventory – Provide detailed list of primary replacement parts, components, and spares typically held in inventory.
7. Test Equipment and Physical Plant – Include an inventory of all test facility equipment owned and used regularly by the Service Department. Provide description of physical plant and space utilization.
8. Copies of all business and professional licenses and insurance certificates.

I. For the purposes of this contract, Dealers, Jobbers, and Sales Representatives SHALL NOT be considered as eligible participants.

J. Without prejudice to others, the following contractors are considered qualified to install Orchestra Pit filler systems and do not need to submit contractor's qualifications:

Staging Concepts
7008 Northland Dr.
Suite 150
Minneapolis, MN 55428
662-418-6442
Contact Courtney Schmitz

StageRight Corporation
495 Pioneer Parkway
Clare, MI 48617
800-438-4499 ext.349
Kip Weis

Wenger Corporation
555 Park Dr.
Owatonna, MN 55060
(507) 774-8352
Contact: Damon Atwood

1.7 SUBMISSIONS

A. Drawings:

1. Submit plans, elevations, sections, and equipment schedules to the Architect of all systems, components, installation methods, and schedules showing all information necessary to fully explain the design features, appearance, function, fabrication, load ratings, installation and use of system components in all phases of operation.

2. The drawings shall be no less detailed than as provided in the contract documents.
3. System plans, elevations, and sections shall be submitted on minimum D-size (24x36) sheets and shall be drawn in no less than 1/4" =1'-0" scale.
4. Submit in quantities as required by the Architect.

B. Catalog Cuts: In lieu of detailed equipment drawings, the Contractor may submit catalog cuts for standard, unmodified equipment.

1. All catalog cuts shall contain full information on dimensions, construction, applications, load ratings, etc., to permit proper evaluation.
2. Catalog cuts shall be properly identified as to their intended use. Any options or variations shall be clearly noted.
3. Detailed drawings of any modified standard equipment shall be submitted for approval as described in Section 1.04.A.
4. Catalog cut sheets shall be prepared and bound in a professional manner, with each sheet properly indexed to a "Table of Contents". Loose or stapled sheet sets are not permitted.
5. All copies of catalog cut sheets must be clear and legible.
6. Submit in quantities as required by the Architect.

C. Samples: Provide any requested samples of hardware or deck material choices for selection and approval. Hardware or component samples shall be provided upon written request. Submit in quantities as required by the Architect.

D. Approvals: All submissions must be approved per the requirements of the project's general conditions prior to the beginning any fabrication, installation, or erection. Such approval does not relieve the Contractor of the responsibility of providing equipment in accordance with the specifications or of providing fully operational and safe systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Due to their interrelated design, all the stage equipment in this specification shall be supplied by one qualified stage rigging manufacturer who shall be responsible for coordinating the required design and installation details

B. One approved stage platforming manufacturer shall supply all platforms in this specification.

C. In general, the component units have been described in detail in order to obtain the required performance. The specifications are minimum requirements, and in no case will items of lesser design be acceptable. Only components that in the opinion of the Architect upgrade the unit in all ways will be considered. Manufacturers' standard off-the-shelf components will not be considered unless they meet the minimum specifications.

D. The use of "brand names" has been held to a minimum in these specifications and when used are to establish a quality and performance standard. Items by other manufacturers not included in the Approved Manufacturers list may be used after written approval has been obtained from the Architect.

E. Substitutes shall be considered only when they are submitted fourteen days prior to the bid date, and are accompanied by sufficient drawings, catalog data, specifications, and technical information for evaluation.

F. The following are approved theatrical platform manufacturers:

Staging Concepts
7008 Northland Dr.
Suite 150
Minneapolis, MN 55428
662-418-6442
Contact Courtney Schmitz

StageRight Corporation
495 Pioneer Parkway
Clare, MI 48617
800-438-4499 ext.349
Kip Weis

Wenger Corporation
555 Park Dr.
Owatonna, MN 55060
(507) 774-8352
Contact: Damon Atwood

G. Basis of design product: SC90 platforms and understructure based on the design by Staging Concepts.

2.2 GENERAL REQUIREMENTS

A. All materials and equipment shall be furnished in the quantities needed to complete the scope of the work.

B. All materials and equipment used in this project shall be new, unused and of the latest models and design. Refurbished materials and equipment are not permitted.

C. Any electrical devices installed shall be UL listed and NEC approved.

D. Any item of equipment or hardware that may not be specifically shown on the drawings or specified herein but required for proper system operation or installation shall be furnished and installed and be of the highest quality available.

E. Prior to fabrication of materials, the Contractor shall visit the site and measure for the exact fit of all materials and assure himself of the appropriateness of the materials.

F. Machining and Finishing: Operating parts of all rigging equipment shall be suitably machine finished. Tolerances, fit and finish, where not specified, shall conform to good trade practices.

G. Where dimensions and loading capacities have been omitted from this specification, they are to be determined by the bidder in accordance with accepted industry standards and the guidelines in this section. In no way shall the Contractor be relieved of the primary responsibility to provide a safe, fully functional system.

H. All equipment shall be built and installed to facilitate future maintenance and replacement.

I. The mechanical fabrication and workmanship shall incorporate best practices for good fit and finish. There shall not be any burrs or sharp edges to cause a hazard, nor shall there be any sharp corners accessible to personnel.

J. All finishes which are disturbed during shipping and installation shall be touched up to match the original.

2.3 PERFORMANCE REQUIREMENTS

A. Structural Performance:

B. Single side, indoor/outdoor, weather resistant, portable platform. Design platform to be fully field repairable and to function with supports and to comply with the following:

1. 1. Edging: 4 inches [102 millimeter] high extruded 6105-T5 aluminum frame (including protective edge), mill finish (standard), powder coat and anodizing as an option. Design frame to accept:
   a. Built-in Roto-Lock® system.
2. 2. Subfloor: 1 inch [25 millimeter] thick, Structural 1 (S1) marine grade plywood.
   a. Finished surface: Polypropylene (black)
   b. Aluminum skin backer.
3. The deck will support a uniform live load of 150 psf [733 kg/sq. meter]. Lateral sway-bracing loads: 24 lbs/ft (350 N/m) applied parallel to, and 10 lbf/ft. (145.9 N/m) applied perpendicular to platforms. (standard). Additional support beams can be installed to increase load rating.
4. Stage Platforms and Risers: Point Load: 1,500lb (6.7 kN) applied via 1” (2.5 cm) diameter pin.
5. Stage Platforms and Risers: Fully replaceable components including corners, frame and wood deck. Replaceable in the field with common tools.

2.4 FABRICATION

A. General: Provide portable stages and risers meeting requirements of Performance Requirements Article, with the following characteristics:

1. Portable and storable in space indicated.
2. Easily set up and disassembled without the use of special tools or loose fasteners.
3. Modular and reconfigurable.
4. Platform components replaceable with common tools to include corners, frame sections, and platform decking.
5. Platforms supported by individual legs that are storable inside the platform frame.
6. Platforms designed for comfortable and secure power-grip (closed-grip) anywhere around entire deck perimeter.
7. Lightweight leg sets/understructures - 40” (101 cm) tall or shorter weigh less than 10 lbs (4.5 kg).

2.5 STANDARD MANUFACTURED COMPONENTS

A. Deck Panels: Manufacturer's standard panel construction.

1. Decks shall be single sided.
2. Deck units shall be no larger than 4'-0" x 8'-0" (or equivalent square footage) and/or weigh more than 100 lbs.
3. The deck finished surface shall be Black polyvinyl, as specified by the Architect.
4. All platform materials shall meet or exceed Class "A" fire ratings where applicable.

B. Leg Supports:

1. General: Design support system to the following:
2. Legs: 1-1/4 inch [32 millimeter] Schedule 40, 6105-T5 aluminum pipe. Join leg to platform in a compression loading condition. Hold in place by a 3/8 inch [10 millimeter], 16 socket head cap screw with plastic tightening knob.

    a. Fixed heights: 4 inches to 96 inches (102 millimeters to 2438 millimeters) (standard) (stabilizer bracing required when at height of 30 inches [762 millimeters] and over). Custom heights available upon request.
    b. Adjustable heights:
    c. 12 inches to 16 [305 millimeters to 406 millimeters
    d. 36 inches to 48 inches [914 millimeters to 1219 millimeters] (stabilizer bracing required).
    e. Terminate each leg with a non-marring leveling foot to allow for a 2 inch [51 millimeter] fine height adjustment. Fabricate foot from molded skid resistant PVC pad.
    f. Capable of being erected without use of tools.
    g. Finish: Mill (standard)
    h. Stabilizer-bracing (when required): 1-1/4 inch [32 millimeters] Schedule 40 6105-T5 aluminum pipe. Connect to leg supports with slip-on structural fitting.
    i. Provide platforms with storage clips to store legs under platforms.

2.6 ACCESSORIES

A. Storage Carts: Arena platform cart with straps.

1. Material: Tubular steel with welded joints. Grind weld joints smooth.
2. Dimensions:100" L x 48" W x 58"H (fully loaded)
3. Casters: Provide 4 casters for each cart; 2 fixed and 2 swivels.
4. Caster Sizes: 4-inch (102 millimeters) or 6-inch (152 millimeters) diameter capacity of
5. Capacity: 15 – 4' x 8' platforms each.
6. Design transport carts to contain intended load in a secure and organized manner.
7. Leg Storage Clips: Provide bottom-of-deck panel leg storage clips.

B. Closure Panels:

1. Provide closure panels meeting the following requirements as directed by design:
2. 1. Material: Plywood substrate construction. Provide polyethylene tee-molding at the top.
3. Finish: Match deck surface.
4. Attach closure panels with Snap-On clips ("button-lock" brackets) or set screw to platform frame.

C. E. Skirting:

1. Material: Flame retardant Wyndham fabric.

a. Thread Color: Match fabric.
b. Pleat skirts with 50 percent fullness.
c. Style: Shirred or box pleat.
d. Reinforce the top hem with continuous webbing.
e. Attachment: Attach to platforms with Velcro and extruded plastic clips.

2.7 FINISHES

1. Aluminum Framing: Mill Finish (standard). Powder coat or anodizing as an option.

PART 3 – EXECUTION

3.1 GENERAL

A. Fabricate and install items in conformity with applicable trade practices and manufacturer's recommendations, UNLESS SPECIFICALLY EXCEPTED BY SPECIFICATIONS OR DRAWINGS

B. Carry out shop and field welding in full conformity with applicable AISC, ASME, AWS and ASA standards.

C. Comply with local codes. In absence of local codes, comply with AISC, NEC, and ASA standards as applicable.

D. Furnish, turn over to Owner's designated representative and obtain receipt for all spare parts and equipment required as part of this project.

E. Workmanship and finish must be first class in every particular and strictly in accordance with the best practices. The work shall be made in accordance with the reviewed shop drawings. Work made in sections shall be carefully fitted together. Units shall be properly laid out and spaced between terminals.

F. Only experienced riggers shall be used on the work and a supervisor carrying an ETCP Certification in Theatrical Rigging shall be present during the entire installation.

G. An experienced, qualified representative of the orchestra pit filler manufacturer shall be present at all times during the installation.

H. The entire installation shall be made with the assistance of the factory-authorized representative of the equipment manufacturer. The equipment manufacturer's recommendations and instructions are to be fully implemented.

I. Storage: The Contractor shall be responsible for storage of equipment, tools, and its equipment during the period of the installation.

J. Damage Protection: The Rigging Contactor shall take all precautions necessary to prevent damage to the multi-purpose room floor, walls, and all other existing finishes during installation.

3.2 SHOP DRAWINGS AND SUBMITTAL

A. Within thirty (30) days of bid award and prior to beginning work, prepare and submit shop drawings to the Architect for approval. These drawings shall be detailed and complete on all phases of the installation. The drawings shall include details of all rigging hardware components. Shop drawings shall be approved by the Architect prior to fabrication, installation or erection has begun. Minimum plates required shall be:

1. Title sheet
2. Scale plan and section drawings
3. Scale elevation drawings of each line set type included (fire curtain, general purpose sets, electric sets, etc.)
4. Assembly drawings of all major components including dimensions, weights and bill of materials.
5. Electrical riser, interconnect, and block diagrams
6. Scale drawings of all electrical and control system components, complete assemblies, and control stations
7. Scale location drawings of all electrical components required (both those provided by the rigging contractor and those provided by the electrical contractor). This drawing shall be used by the electrical contractor to coordinate the electrical “rough in” and correct placement is the responsibility of the rigging contractor

B. Approval of shop drawings does not relieve the Contractor of the responsibility of providing equipment in accordance with these specifications. Any deviations from the specifications shall be "starred" and noted in 1/4" high letters. Only deviations which upgrade the quality of the equipment shall be considered.

C. Individual components shall be detailed as required to illustrate materials, thicknesses, sizes, capacities and methods of assembly or attachment to adjoining components.

D. Shop drawings shall show all system loads, safety factors, system capacities and imposed building loads.

E. Specific notes shall be included pertaining to the adequacy of the related structural steel, miscellaneous metals and electrical accommodations as they appear on the contract drawings.

F. Shop drawing shall be fully coordinated with all other disciplines and site data and dimensions.

G. Included with the show drawings shall be a submittal package including:

1. Catalog information and cut sheet of all standard equipment.
2. Catalog information and cut sheets of all electrical components.
3. Owner’s manuals for everything electrical in nature and any complex mechanical machinery (e.g., winches).
4. Shop drawing and submittals shall be revised and resubmitted as required.

3.3 FABRICATION

A. Machine finish operating parts to standard trade tolerances, fits, and finishes, unless otherwise specified.

B. Paint all fabricated work flat black unless specified on the drawings or herein.

3.4 JOB CONDITIONS

A. Take required measurements at the building. Consult with the various other Contractors whose work adjoins this work. This Contractor shall be responsible for the proper coordination of all details of the installation.

B. Do drilling and fitting and work of similar character required in the fitting and setting of the materials in place and do cutting and fitting required in connection with the fitting of these materials to the adjoining work of other Contractors.

C. Provide connecting members needed for properly supporting and securing the work to the masonry, joints, walls, structural members, or other parts of the building as may be best suited for each case.

3.5 INSTALLATION

A. Position items accurately as indicated on Drawings and true to plumb line and level.

B. Use fittings and clips conforming to cable manufacturer's recommendations as to size, number, and method of installation.

C. Form rope and cable eyes over properly sized thimbles at requisite connection points.

D. Do required cutting, drilling, tapping, and welding necessary to properly install work.

E. Consult and coordinate work with trades doing adjoining work.

F. Install all rigging components to maximize batten travel.

G. Provide completed installation, ready for satisfactory operation, prior to tests and inspection. Advise the Architect in writing that the installation is so completed and ready for acceptance tests and inspection.

H. Installation practices:

1. Installation practices shall be in accordance with Federal OSHA Safety and Health Standards and all local codes. Certified welders shall perform all field welding in full compliance with the latest edition of the Structural Welding Code (ANSI/AWS D1.1) and any other applicable local and state codes and regulations.
2. Equipment shall be installed in a workmanlike manner, per plans and specifications. Equipment shall be aligned, adjusted, and trimmed for the most efficient operation, the greatest safety and for the best visual appearance.
3. Field Welding: All proposed field welding shall be described and submitted in detail in the form of sketches and/or drawings for review by the Architect/Engineer of Record/Engineer of Record.
4. Touch-Ups: Any welds or cuts shall be touched up to match disturbed finishes. All finishes which are disturbed during shipping and installation shall be touched up to match the original.

3.6 INSPECTION

A. The job will be inspected periodically by the Architect and/or his representative while work is in progress, and the Contractor shall accord his full cooperation in the examination of work and materials, which may include dismantling of the equipment for examination of component interior parts. Any equipment found not meeting the specification shall be removed immediately from the job.

B. Arrange for the Consultants inspection of the system. Upon completion of the Consultants punch list, arrange for demonstration of the system by the manufacturer's designated representative at a time acceptable to the Consultant and the Owner. Demonstrate the full capabilities of the complete system and obtain the signatures of those persons attending the demonstration. Furnish all equipment and personnel required for the demonstration.

3.7 CLEANUP AND PROTECTION

A. Site Clean Up and Other Protection: The Contractor shall be responsible for all clean up related to its work, including the removal of packing materials etc. and the protection of existing surfaces or equipment. Repairs to damage caused by the Contractor to any item or surface are the sole responsibility of the Contractor.

B. Protection of Installed Equipment: The equipment described in this section is considered to be finished equipment and is to be protected during and after installation from excessive dirt and damage caused by other work.

C. Equipment Cleaning: All equipment and the areas around the equipment shall be cleaned prior to final inspection and acceptance.

3.8 TESTING AND COMPLETION

A. Progress Inspections: During the installation of equipment the Contractor shall arrange for access as necessary for inspection of equipment by the Architect and/or the Consultant upon reasonable timely notice.

B. Special Testing: If specifications, the Architect, laws, ordinances, or any public authority require any work to be specially tested or approved, the Contractor shall give the Architect timely notice of its readiness for inspection, and of dates of inspections to be made by other authorities.

C. Completion Inspection and Testing:

1. Upon completing the installation of all equipment specified under this section, the Contractor shall notify the Architect, who will schedule an inspection.
2. At the time of inspection, the Contractor shall furnish sufficient workers to operate all equipment and to perform such adjustments and tests as may be required by the Architect and/or their Consultants.
3. Any equipment which fails to meet with approval, shall be repaired or replaced with suitable equipment. If determined by the Architect, the inspection may be re-scheduled and held under the same conditions as specified herein.
4. Any additional costs incurred by the Architect their Consultants due to inspection re-scheduling because the work is incomplete or defective, shall be borne by the Contractor.
5. At the time of these inspections, no other work shall be performed in the auditorium and stage areas.
6. All temporary bracing, scaffolding, etc. shall be removed to permit full operation of, and access to, all equipment.

7. Final approval will be withheld until all systems have been thoroughly tested and found to be in first class operating condition in every particular.
8. Upon completion and approval of the work, the Contactor shall remove all tools, excess supplies, and trash from the work areas. Any equipment supplied under this section, but not installed, shall be inventoried, cleaned, organized, and turned over to the Owner. The Contractor shall leave the stage and all work areas in a “broom clean” condition.
9. Upon completion and approval of the work, the Contactor shall leave the platforming set up in the configuration of the owners choosing.

3.9 INSTRUCTION

A. Provide at least six (6) hours of instruction of the Orchestra Pit Filler System to Owner's personnel in the care of the complete system. Training shall include set up, take down and storage of the complete Orchestra Pit Filler System.

B. Upon completion and approval of the work, the Contactor shall leave the platforming set up in the configuration of the owners choosing.

C. The Contractor shall notify the Owner, Architect, and Theater Consultant of the time and place of this training, no later than two weeks in advance.

D. Obtain the signatures of each person instructed, and their concurrence that they are comfortable with the instruction received.

3.10 WARRANTY & INSPECTIONS

A. Warranty: The Contractor shall provide a One (1) year written guarantee against defects in materials and workmanship. Within this period, the Contractor shall provide any required maintenance or replacement within 30 days of written notification by the Owner, except for safety related items that shall be corrected within 48 hours of notification. Subsequent to the expiration of the guarantee period, the Contractor agrees to furnish repair and maintenance service, at the Owner’s expense, within 30 days of request for such service.

B. One Year Inspection: At one year after the date of final acceptance, and as part of this contract, the Contractor shall provide a comprehensive inspection of all installed systems and components. Make all adjustments as may be required by normal wear and tear. This inspection shall be scheduled directly with the Owner and shall be done at the Owner’s convenience.

3.11 OPERATIONS AND MAINTENANCE MANUALS

A. Upon completion of the work the Orchestra Pit Filler Contractor shall submit four detailed printed copies of the operations and maintenance Manuals, 2 for the owner, 1 for the architect/engineer of record and one for the consultants. The contractor shall also CD ROMs with the Operations and Maintenance Manuals in PDF form with a hyper link table of contents, also any CAD drawings including as built shop drawings, equipment descriptions and any required certificates or warranties, and parts lists or other electronically produced submittal items. Submit in quantities as required by the Architect. Before distribution of the manuals submit one copy to the consultant for approval.

B. Manual shall, at the minimum, include the follow:

1. Contractor's service contact information
2. Set of reduced sized "as-build" drawings based on the approved shop drawings
3. Copy of the submittal package.
4. System warranty
5. Complete operating instructions
6. Safety guide
7. Maintenance procedures, including schedules.
8. Inspection criteria in sufficient detail so that users can realistically carry out system inspections.
9. CD ROM of all data with files in PDF format

END OF SECTION 11 61 35

SECTION 11 61 36
DRAMA LAB PORTABLE STAGE PLATFORMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SCOPE

A. Intent: This specification covers the fabrication, furnishing, delivery, and installation of a complete Drama Lab Portable Stage Platforming

B. The form of the contract, general conditions, and the project drawings are considered to be part of these specifications.

A. Definitions: For this project, the following entities are referenced:

1. Owner: St. Lucie County School Board
2. Architect: Schenkel Shultz Architects
3. Theatre Consultant: TSG Design Solutions, Inc. Now part of TLC

C. General: Provide all items and work necessary for complete, safe, fully functional systems as specified, including:

1. Tools, scaffolding, equipment, labor and supervision, even though they may not be specifically enumerated.
2. Verification of dimensions and conditions at the job site.
3. Coordination of the work of this section with stage rigging and lighting systems, and other building systems whether under this contract or performed under a separate, prime contract.
4. Notification to the Architect/Engineer of any conditions, measurements, quantities, or other data, as required for proper execution, fit and completion of all work, and for safe and proper operating clearances.
5. Shipment of equipment to job site and the secured storage of all non-fixed equipment.
6. Installation and completion, in accordance with these Specifications, related Drawings, the Equipment Manufacturer's recommendations, established trade criteria, and all applicable code requirements.
7. Inspection, demonstration, and necessary adjustment of the completed installation by the Contractor's installation personnel.
8. Preparation and submission of complete record drawings and operational and maintenance data and certificates.
9. A one-year inspection by the Contractor.

D. Errors and Omissions: Any errors, omissions, or ambiguities found in these documents do not relieve the Contractor of the responsibility of providing all items necessary for complete, safe, fully functional systems. Any errors, omissions, or ambiguities shall be brought to the attention of the

Architect/Engineer of Record, Construction Manager, Owner, and/or Theater Consultant for clarification.

1.3 WORK INCLUDED:

A. Without restricting the volume or generality of the above scope of work to be performed under this section this section shall include, but not be limited to, the following.

1. Provide portable platforms railings and steps that comprise the platform system in quantities and arrangements as shown in the contract drawings. Platforms shall be designed to work in a single configuration as a functioning platform system that is level.
2. The Installation Contractor shall provide for the demonstration of the set-up and breakdown of the platform system.
3. The Installation Contractor shall provide the systems manuals.
4. The Installation Contractor shall provide the systems warranty.

1.4 GENERAL REQUIREMENTS

A. Field Conditions: This project is the provision and installation of new systems within a new venue. All bidders shall fully inform themselves of the conditions under which the work is to be performed. No additional compensation or time extension will be given for conditions of which the bidder could have been fully aware prior to bid.

B. Safety: The systems shall conform to all applicable code requirements and shall be provided and installed in conformance to industry standards of operation and practices. All materials, arrangements, and procedures shall comply with applicable code requirements, allowing the end user to arrange and operate a safe assembly and working environment for the audience and user's personnel.

C. Insurance: In the absence of more stringent requirements, the Contractor shall maintain sufficient injury and property liability insurance coverage throughout the project's scheduled timetable, including workmen's compensation coverage for the Contractor's employees.

1.5 REFERENCES

A. American Hardboard Association (AHA):

4. AHA A135.4-95: Basic Hardboard.

B. American Plywood Association (APA).

1. Performance Standards and Policies for Structural Use Panels.

C. American Society of Civil Engineers (ASCE):

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

D. Architectural Woodwork Institute (AWI):

1. Quality Manual, 8th Edition.

E. ASTM International (ASTM):

1. ASTM A36/A 36M - Standard Specification for Carbon Structural Steel.
2. ASTM A500 -Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
3. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
4. ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low Alloy with Improved Formability, and Ultra High Strength.
5. ASTM B85 - Standard Specification for Aluminum Alloy Die Castings.
6. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
7. ASTM B221 - Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
8. ASTM B429 - Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
9. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
10. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
11. ASTM E 413 - Classification for Rating Sound Transmission

1.6 INSTALLING CONTRACTOR'S QUALIFICATIONS

A. Only qualified contractors shall be used.

B. The work of this section will be contracted to a single firm, referred to as the contractor.

C. All equipment and installation shall be the responsibility of a single contractor who shall own and operate a full-time, staffed shop for the fabrication and/or assembly of stage equipment. This Contractor shall assume complete responsibility for the design, fabrication, transportation, and installation of the work in this Section, and shall hold the Owner, Architect, Theater Consultant, and all their Employees and Consultants harmless for any costs for errors or omissions associated with the work of this Section and any action arising there from.

D. The Contractor shall have at least ten (10) years' experience in the installation of similar equipment and systems for professional and educational theaters. If requested, the Contractor shall submit a representative list of professional theater installations.

E. The Contractor shall be a member in good standing of the Production Lighting and Sound Association (PLASA) and maintain qualifying membership for the duration of the project.

F. The contractor shall have maintained for the five years preceding the bid date, a suitably staffed and equipped service organization which has continuously offered maintenance and repair services for systems of the nature, size, scope and complexity to that contemplated by this specification.

G. The contractor shall maintain for the duration of this contract all required business and professional licenses and insurance.

H. The contractor shall demonstrate to the satisfaction of the owner, through submittals presented in accordance with the project timetable, that the contractor meets all the above qualifications. The minimum contractor qualification submittal shall include the following:

1. Statement of company history. Include a breakdown by percentage of gross sales of all business activities the contractor is involved in for each of the last 5 years (e.g., system installation = 30%, expendable sales = 40%, service = 20%, design and other professional services = 10%, etc.).
2. Previous experience: Provide a list of four installations (for tension wire grid a listing of10 equivalent installations are required) of the type and size contemplated by these specifications, currently in use as originally installed, in which a theatre / system consultant was involved, completed in the last 5 years and the following information regarding each installation:

    a. Name and address of each installation.
    b. Facility owner and telephone number.
    c. Name, address, and phone number of a person regularly employed by the owner, who is familiar with the operation of the systems and who has no connection or business connections with the contractor except as the contractor shall fully disclose
    d. Name, address, and phone number of the theatre or system consultant, along with the names of all the consultant's personnel directly involved.
    e. System shop drawings. These will be returned if the contractor provides a call tag or return postage.
    f. Owner's manual drawings - These will be returned if the contractor provides a call tag or return postage.
    g. System as-built drawings - These will be returned if the contractor provides a call tag or return postage.
    h. List of contractor's personnel involved with each person's responsibility on the project.
    i. Name, address and phone number of the general contractor, along with the names of all key GC personnel directly involved.
    j. Name address and phone number of the electrical contractor, along with the names of all key EC personnel directly involved.
3. Statement of current company capabilities and ownership.
4. Key Personnel. For each of the key personnel listed below; Include individual's name, title, and number of continuous years of service to contractor. Include a resume detailing industry experience, and role within organization (include only full-time/regular staff employees; not independent contractor, freelance, or temporary positions). List all industry certifications held, training courses attended, and continuing education credits, including dates of attendance. List recently completed projects, scope of project, and completion dates.
    a. Project Manager
    b. Senior Technician
    c. Service Manager
5. Other Department Staff. Include size of staff and experience of each staff member.
6. Replacement and Spare Parts Inventory – Provide detailed list of primary replacement parts, components, and spares typically held in inventory.
7. Test Equipment and Physical Plant – Include an inventory of all test facility equipment owned and used regularly by the Service Department. Provide description of physical plant and space utilization.
8. Copies of all business and professional licenses and insurance certificates.

I. For the purposes of this contract, Dealers, Jobbers, and Sales Representatives SHALL NOT be considered as eligible participants.

J. Without prejudice to others, the following contractors are considered qualified to install Drama Lab Portable Stage Platforming systems and do not need to submit contractor's qualifications:

Staging Concepts
7008 Northland Dr.
Suite 150
Minneapolis, MN 55428
662-418-6442
Contact Courtney Schmitz

StageRight Corporation
495 Pioneer Parkway
Clare, MI 48617
800-438-4499 ext.349
Kip Weis

Wenger Corporation
555 Park Dr.
Owatonna, MN 55060
(507) 774-8352
Contact: Damon Atwood

1.7 SUBMISSIONS

A. Drawings:

1. Submit plans, elevations, sections, and equipment schedules to the Architect of all systems, components, installation methods, and schedules showing all information necessary to fully explain the design features, appearance, function, fabrication, load ratings, installation and use of system components in all phases of operation. Submit for approval before beginning any fabrication, installation, or erection.
2. Include fabrication and installation details. Distinguish between factory and field work.
3. Include plans, elevations, sections, attachments and work by other trades.
4. The drawings shall be no less detailed than as provided in the contract documents.
5. System plans, elevations, and sections shall be submitted on minimum D-size (24x36) sheets and shall be drawn in no less than 1/4" =1'-0" scale.
6. Submit in quantities as required by the Architect.

B. Catalog Cuts: In lieu of detailed equipment drawings, the Contractor may submit catalog cuts for standard, unmodified equipment.

1. All catalog cuts shall contain full information on dimensions, construction, applications, load ratings, etc., to permit proper evaluation.
2. Catalog cuts shall be properly identified as to their intended use. Any options or variations shall be clearly noted.
3. Detailed drawings of any modified standard equipment shall be submitted for approval as described in Section 1.04.A.
4. Catalog cut sheets shall be prepared and bound in a professional manner, with each sheet properly indexed to a "Table of Contents". Loose or stapled sheet sets are not permitted.
5. All copies of catalog cut sheets must be clear and legible.
6. Submit in quantities as required by the Architect.

C. Samples: Provide any requested samples of hardware or deck material choices for selection and approval. Hardware or component samples shall be provided upon written request. Submit in quantities as required by the Architect.

D. Approvals: All submissions must be approved per the requirements of the project's general conditions prior to the beginning any fabrication, installation, or erection. Such approval does not relieve the Contractor of the responsibility of providing equipment in accordance with the specifications or of providing fully operational and safe systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Due to their interrelated design, all the stage equipment in this specification shall be supplied by one qualified stage rigging manufacturer who shall be responsible for coordinating the required design and installation details

B. One approved stage platforming manufacturer shall supply all platforms in this specification.

C. In general, the component units have been described in detail in order to obtain the required performance. The specifications are minimum requirements, and in no case will items of lesser design be acceptable. Only components that in the opinion of the Architect upgrade the unit in all ways will be considered. Manufacturers' standard off-the-shelf components will not be considered unless they meet the minimum specifications.

D. The use of "brand names" has been held to a minimum in these specifications and when used are to establish a quality and performance standard. Items by other manufacturers not included in the Approved Manufacturers list may be used after written approval has been obtained from the Architect.

E. Substitutes shall be considered only when they are submitted fourteen days prior to the bid date, and are accompanied by sufficient drawings, catalog data, specifications, and technical information for evaluation.

F. The following are approved theatrical platform manufacturers:

Staging Concepts
7008 Northland Dr.
Suite 150
Minneapolis, MN 55428
662-418-6442
Contact Courtney Schmitz

StageRight Corporation
495 Pioneer Parkway
Clare, MI 48617
800-438-4499 ext.349
Kip Weis

Wenger Corporation
555 Park Dr.
Owatonna, MN 55060

(507) 774-8352
Contact: Damon Atwood

G. Basis of design product: SC90 platforms and understructure based on the design by Staging Concepts.

2.2 GENERAL REQUIREMENTS

A. All materials and equipment shall be furnished in the quantities needed to complete the scope of the work.

B. All materials and equipment used in this project shall be new, unused and of the latest models and design. Refurbished materials and equipment are not permitted.

C. Any electrical devices installed shall be UL listed and NEC approved.

D. Any item of equipment or hardware that may not be specifically shown in the drawings or specified herein but required for proper system operation or installation shall be furnished and installed and be of the highest quality available.

E. Prior to fabrication of materials, the Contractor shall visit the site and measure for the exact fit of all materials and assure himself of the appropriateness of the materials.

F. Machining and Finishing: Operating parts of all rigging equipment shall be suitably machine finished. Tolerances, fit and finish, where not specified, shall conform to good trade practices.

G. Where dimensions and loading capacities have been omitted from this specification, they are to be determined by the bidder in accordance with accepted industry standards and the guidelines in this section. In no way shall the Contractor be relieved of the primary responsibility to provide a safe, fully functional system.

H. All equipment shall be built and installed to facilitate future maintenance and replacement.

I. The mechanical fabrication and workmanship shall incorporate best practices for good fit and finish. There shall not be any burrs or sharp edges to cause a hazard, nor shall there be any sharp corners accessible to personnel.

J. All finishes which are disturbed during shipping and installation shall be touched up to match the original.

2.3 PERFORMANCE REQUIREMENTS

A. Structural Performance:

B. Single side, indoor/outdoor, weather resistant, portable platform. Design platform to be fully field repairable and to function with supports and to comply with the following:

1. 1. Edging: 4 inches [102 millimeter] high extruded 6105-T5 aluminum frame (including protective edge), mill finish (standard), powder coat and anodizing as an option. Design frame to accept:

a. Built-in Roto-Lock® system.

2. 2. Subfloor: 1 inch [25 millimeter] thick, Structural 1 (S1) marine grade plywood.
   a. Finished surface: Polypropylene (black)
   b. Aluminum skin backer.
3. Deck will support a uniform live load of 150 psf [733 kg/sq. meter]. Lateral sway-bracing loads: 24 lbs/ft (350 N/m) applied parallel to, and 10 lbf/ft. (145.9 N/m) applied perpendicular to platforms. (standard). Additional support beams can be installed to increase load rating.
4. Stage Platforms and Risers: Point Load: 1,500lb (6.7 kN) applied via 1" (2.5 cm) diameter pin.
5. Stage Platforms and Risers: Fully replaceable components including corners, frame and wood deck. Replaceable in the field with common tools.

2.4 FABRICATION

A. General: Provide portable stages and risers meeting requirements of Performance Requirements Article, with the following characteristics:

1. Portable and storable in space indicated.
2. Easily set up and disassembled without the use of special tools or loose fasteners.
3. Modular and reconfigurable.
4. Platform components replaceable with common tools to include corners, frame sections, and platform decking.
5. Platforms supported by individual legs that are storable inside the platform frame.
6. Platforms designed for comfortable and secure power-grip (closed-grip) anywhere around entire deck perimeter.
7. Lightweight leg sets/understructures - 40" (101 cm) tall or shorter weigh less than 10 lbs (4.5 kg).

2.5 STANDARD MANUFACTURED COMPONENTS

A. Deck Panels: Manufacturer's standard panel construction.

1. Decks shall be single sided.
2. Deck units shall be no larger than 4'-0" x 8'-0" (or equivalent square footage) and/or weigh more than 100 lbs.
3. The deck finished surface shall be Black polyvinyl, as specified by the Architect.
4. All platform materials shall meet or exceed Class "A" fire ratings where applicable.

B. Leg Supports:

1. General: Design support system to the following:
2. Legs: 1-1/4 inch [32 millimeter] Schedule 40, 6105-T5 aluminum pipe. Join leg to platform in a compression loading condition. Hold in place by a 3/8 inch [10 millimeter], 16 socket head cap screw with plastic tightening knob.

   a. Fixed heights: 4 inches to 96 inches (102 millimeters to 2438 millimeters) (standard) (stabilizer bracing required when at height of 30 inches [762 millimeters] and over). Custom heights available upon request.
   b. Adjustable heights:
   c. 12 inches to 16 [305 millimeters to 406 millimeters

d. 36 inches to 48 inches [914 millimeters to 1219 millimeters] (stabilizer bracing required).
e. Terminate each leg with a non-marring leveling foot to allow for a 2 inch [51 millimeter] fine height adjustment. Fabricate foot from molded skid resistant PVC pad.
f. Capable of being erected without use of tools.
g. Finish: Mill (standard)
h. Stabilizer-bracing (when required): 1-1/4 inch [32 millimeters] Schedule 40 6105-T5 aluminum pipe. Connect to leg supports with slip-on structural fitting.
i. Provide platforms with storage clips to store legs under platforms.

2.6 ACCESSORIES

A. Design accessories to attach without the use of tools and shall be easily removable.
1. Design accessories to attach without the use of tools and shall be easily removable.

B. Storage Carts: Arena platform cart with straps.

1. Material: Tubular steel with welded joints. Grind weld joints smooth.
2. Dimensions:100” L x 48” W x 58”H (fully loaded)
3. Casters: Provide 4 casters for each cart; 2 fixed and 2 swivels.
4. Caster Sizes: 4-inch (102 millimeters) or 6-inch (152 millimeters) diameter capacity of
5. Capacity: 15 – 4’ x 8’ platforms each.
6. Design transport carts to contain intended load in a secure and organized manner.
7. Leg Storage Clips: Provide bottom-of-deck panel leg storage clips.

C. Closure Panels:

1. Provide closure panels meeting the following requirements as directed by design:
2. 1. Material: Plywood substrate construction. Provide polyethylene tee-molding at the top.
3. Finish: Match deck surface.
4. Attach closure panels with Snap-On clips (“button-lock” brackets) or set screw to platform frame.

F. Fixed Stair Units
1. Material: 6061 aluminum pipe. Weld joints together and grind smooth.
2. Finish: Mill, anodized or powder coat.
3. Equip stair system with locking mechanism to allow for attachment to side of platform extrusion.
4. Treads: 12 inches deep by 36 inches wide. Rise not to exceed 8”
5. Tread surface: Match deck surface.

G. Guard Rails
1. Material:1.25-inch schedule 40 6105-t6 aluminum extrusion.
2. Finish: Mill, anodized or powder coat.
3. Toe board: 4-inch extruded aluminum toe board where required by code
4. Equip guardrail with locking mechanism to allow for attachment to deck. Design lock mechanism to allow for easy removal.
5. Provide manufacturer’s standard guardrail.
6. IBC compliant guardrail: Space vertical members so that on sphere 4inches in diameter of larger may pass through.

H. E. Skirting:

1. Material: Flame retardant Wyndham fabric.
2. Thread Color: Match fabric.
3. Pleat skirts with 50 percent fullness.
4. Style: Shirred or box pleat.
5. Reinforce the top hem with continuous webbing.
6. Attachment: Attach to platforms with Velcro and extruded plastic clips.

2.7 FINISHES

1. Aluminum Framing: Mill Finish (standard). Powder coat or anodizing as an option.
2. The deck finished surface shall be Black polyvinyl, as specified by the Architect.

PART 3 – EXECUTION

3.1 GENERAL

A. Fabricate and install items in conformity with applicable trade practices and manufacturer's recommendations, UNLESS SPECIFICALLY EXCEPTED BY SPECIFICATIONS OR DRAWINGS

B. Carry out shop and field welding in full conformity with applicable AISC, ASME, AWS and ASA standards.

C. Comply with local codes. In absence of local codes, comply with AISC, NEC, and ASA standards as applicable.

D. Furnish, turn over to Owner's designated representative and obtain receipt for all spare parts and equipment required as part of this project.

E. Workmanship and finishing must be first class in every particular and strictly in accordance with the best practices. The work shall be made in accordance with the reviewed shop drawings. Work made in sections shall be carefully fitted together. Units shall be properly laid out and spaced between terminals.

F. Only experienced riggers shall be used on the work and a supervisor carrying an ETCP Certification in Theatrical Rigging shall be present during the entire installation.

G. An experienced, qualified representative of the Portable Stage Platforming manufacturer shall be present at all times during the installation.

H. The entire installation shall be made with the assistance of the factory-authorized representative of the equipment manufacturer. The equipment manufacturer's recommendations and instructions are to be fully implemented.

I. Storage: The Contractor shall be responsible for storage of equipment, tools, and its equipment during the period of the installation.

J. Damage Protection: The Rigging Contactor shall take all precautions necessary to prevent damage to the multi-purpose room floor, walls, and all other existing finishes during installation.

3.2 SHOP DRAWINGS AND SUBMITTAL

A. Within thirty (30) days of bid award and prior to beginning work, prepare and submit shop drawings to the Architect for approval. These drawings shall be detailed and complete in all phases of the installation. The drawings shall include details of all rigging hardware components. Shop drawings shall be approved by the Architect prior to fabrication, installation or erection has begun. Minimum plates required shall be:

1. Title sheet
2. Scale plan and section drawings
3. Scale elevation drawings of each line set type included (fire curtain, general purpose sets, electric sets, etc.)
4. Assembly drawings of all major components including dimensions, weights and bill of materials.
5. Electrical riser, interconnect, and block diagrams
6. Scale drawings of all electrical and control system components, complete assemblies, and control stations
7. Scale location drawings of all electrical components required (both those provided by the rigging contractor and those provided by the electrical contractor). This drawing shall be used by the electrical contractor to coordinate the electrical “rough in” and correct placement is the responsibility of the rigging contractor

B. Approval of shop drawings does not relieve the Contractor of the responsibility of providing equipment in accordance with these specifications. Any deviations from the specifications shall be "starred" and noted in 1/4" high letters. Only deviations which upgrade the quality of the equipment shall be considered.

C. Individual components shall be detailed as required to illustrate materials, thicknesses, sizes, capacities and methods of assembly or attachment to adjoining components.

D. Shop drawings shall show all system loads, safety factors, system capacities and imposed building loads.

E. Specific notes shall be included pertaining to the adequacy of the related structural steel, miscellaneous metals and electrical accommodations as they appear on the contract drawings.

F. Shop drawing shall be fully coordinated with all other disciplines and site data and dimensions.

G. Included with the show drawings shall be a submittal package including:

1. Catalog information and cut sheet of all standard equipment.
2. Catalog information and cut sheets of all electrical components.
3. Owner’s manuals for everything electrical in nature and any complex mechanical machinery (e.g., winches).
4. Shop drawing and submittals shall be revised and resubmitted as required.

3.3 FABRICATION

A. Machine finish operating parts to standard trade tolerances, fits, and finishes, unless otherwise specified.

B. Paint all fabricated work flat black unless specified on the drawings or herein.

3.4 JOB CONDITIONS

A. Take required measurements at the building. Consult with the various other Contractors whose work adjoins this work. This Contractor shall be responsible for the proper coordination of all details of the installation.

B. Do drilling and fitting and work of similar character required in the fitting and setting of the materials in place and do cutting and fitting required in connection with the fitting of these materials to the adjoining work of other Contractors.

C. Provide connecting members needed for properly supporting and securing the work to the masonry, joints, walls, structural members, or other parts of the building as may be best suited for each case.

3.5 INSTALLATION

A. Position items accurately as indicated on Drawings and true to plumb line and level.

B. Use fittings and clips conforming to cable manufacturer's recommendations as to size, number, and method of installation.

C. Form rope and cable eyes over properly sized thimbles at requisite connection points.

D. Do required cutting, drilling, tapping, and welding necessary to properly install work.

E. Consult and coordinate work with trades doing adjoining work.

F. Install all rigging components to maximize batten travel.

G. Provide completed installation, ready for satisfactory operation, prior to tests and inspection. Advise the Architect in writing that the installation is so completed and ready for acceptance tests and inspection.

H. Installation practices:

1. Installation practices shall be in accordance with Federal OSHA Safety and Health Standards and all local codes. Certified welders shall perform all field welding in full compliance with the latest edition of the Structural Welding Code (ANSI/AWS D1.1) and any other applicable local and state codes and regulations.
2. Equipment shall be installed in a workmanlike manner, per plans and specifications. Equipment shall be aligned, adjusted, and trimmed for the most efficient operation, the greatest safety and for the best visual appearance.
3. Field Welding: All proposed field welding shall be described and submitted in detail in the form of sketches and/or drawings for review by the Architect/Engineer of Record/Engineer of Record.
4. Touch-Ups: Any welds or cuts shall be touched up to match disturbed finishes. All finishes which are disturbed during shipping and installation shall be touched up to match the original.

3.6 INSPECTION

A. The job will be inspected periodically by the Architect and/or his representative while work is in progress, and the Contractor shall accord his full cooperation in the examination of work and materials, which may include dismantling of the equipment for examination of component interior parts. Any equipment found not meeting the specification shall be removed immediately from the job.

B. Arrange for the Consultants inspection of the system. Upon completion of the Consultants punch list, arrange for demonstration of the system by the manufacturer's designated representative at a time acceptable to the Consultant and the Owner. Demonstrate the full capabilities of the complete system and obtain the signatures of those people attending the demonstration. Furnish all equipment and personnel required for the demonstration.

3.7 CLEANUP AND PROTECTION

A. Site Clean Up and Other Protection: The Contractor shall be responsible for all clean up related to its work, including the removal of packing materials etc. and the protection of existing surfaces or equipment. Repairs to damage caused by the Contractor to any item or surface are the sole responsibility of the Contractor.

B. Protection of Installed Equipment: The equipment described in this section is finished equipment and is to be protected during and after installation from excessive dirt and damage caused by other work.

C. Equipment Cleaning: All equipment and the areas around the equipment shall be cleaned prior to final inspection and acceptance.

3.8 TESTING AND COMPLETION

A. Progress Inspections: During the installation of equipment the Contractor shall arrange for access as necessary for inspection of equipment by the Architect and/or the Consultant upon reasonable timely notice.

B. Special Testing: If specifications, the Architect, laws, ordinances, or any public authority require any work to be specially tested or approved, the Contractor shall give the Architect timely notice of its readiness for inspection, and of dates of inspections to be made by other authorities.

C. Completion Inspection and Testing:

1. Upon completing the installation of all equipment specified under this section, the Contractor shall notify the Architect, who will schedule an inspection.
2. At the time of inspection, the Contractor shall furnish sufficient workers to operate all equipment and to perform such adjustments and tests as may be required by the Architect and/or their Consultants.
3. Any equipment which fails to meet with approval, shall be repaired or replaced with suitable equipment. If determined by the Architect, the inspection may be re-scheduled and held under the same conditions as specified herein.
4. Any additional costs incurred by the Architect their Consultants due to inspection re-scheduling because the work is incomplete or defective, shall be borne by the Contractor.
5. At the time of these inspections, no other work shall be performed in the auditorium and stage areas.
6. All temporary bracing, scaffolding, etc. shall be removed to permit full operation of, and access to, all equipment.

7. Final approval will be withheld until all systems have been thoroughly tested and found to be in first class operating condition in every particular.
8. Upon completion and approval of the work, the Contactor shall remove all tools, excess supplies, and trash from the work areas. Any equipment supplied under this section, but not installed, shall be inventoried, cleaned, organized, and turned over to the Owner. The Contractor shall leave the stage and all work areas in a “broom clean” condition.
9. Upon completion and approval of the work, the Contactor shall leave the platforming set up in the configuration of the owners choosing.

3.9 INSTRUCTION

A. Owner Training and Manuals

1. Provide at least three (3) hours of instruction of the Drama Lab Portable Platform System to Owner's personnel in the care of the complete system. Training shall include the setup, takedown and storage of the complete Drama Lab Portable Platform.
2. Upon completion and approval of the work, the Contactor shall leave the platforming set up in the configuration of the owners choosing.
3. The Contractor shall notify the Owner, Architect, and Theater Consultant of the time and place of this training, no later than two weeks in advance.
4. Obtain the signatures of each person instructed, and their concurrence that they are comfortable with the instruction received.

3.10 WARRANTY & INSPECTIONS

A. Warranty: The Contractor shall provide a One (1) year written guarantee against defects in materials and workmanship. Within this period, the Contractor shall provide any required maintenance or replacement within 30 days of written notification by the Owner, except for safety related items that shall be corrected within 48 hours of notification. Subsequent to the expiration of the guarantee period, the Contractor agrees to furnish repair and maintenance service, at the Owner’s expense, within 30 days of request for such service.

B. One Year Inspection: At one year after the date of final acceptance, and as part of this contract, the Contractor shall provide a comprehensive inspection of all installed systems and components. Make all adjustments as may be required by normal wear and tear. This inspection shall be scheduled directly with the Owner and shall be done at the Owner’s convenience.

3.11 OPERATIONS AND MAINTENANCE MANUALS

A. Upon completion of the work the Drama Lab Portable Stage Platforming Contractor shall submit four detailed printed copies of the operations and maintenance Manuals, 2 for the owner, 1 for the architect/engineer of record and one for the consultants. The contractor shall also CD ROMs with the Operations and Maintenance Manuals in PDF form with a hyper link table of contents, also any CAD drawings including as built shop drawings, equipment descriptions and any required certificates or warranties, and parts lists or other electronically produced submittal items. Submit in quantities as required by the Architect. Before distribution of the manuals submit one copy to the consultant for approval.

B. Manual shall, at the minimum, include the follow:

1. Contractor’s service contact information

2. Set of reduced sized “as-build” drawings based on the approved shop drawings
3. Copy of the submittal package.
4. System warranty
5. Complete operating instructions
6. Safety guide
7. Maintenance procedures, including schedules.
8. Inspection criteria in sufficient detail so that users can realistically carry out system inspections.
9. CD ROM of all data with files in PDF format

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SECTION 11 61 43
AUDITORIUM STAGE RIGGING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SCOPE

A. Intent: This specification covers the fabrication, furnishing, delivery, provision, and installation of stage rigging, drapery track systems, stage draperies, and related equipment. The form of the contract, general conditions, and the project drawings are considered to be part of these specifications.

B. Definitions: For this project the following entities are referenced:

1. Owner: St. Lucie County School Board
2. Architect: Schenkel Shultz Architects
3. Theatre Consultant: TSG Design Solutions, Inc.

C. This section requires the fabrication, furnishing, delivery, installation and testing of the rigging and draperies as indicated on the drawings and specified herein.

D. The contractor shall provide all items, materials, equipment, labor, tools, scaffolds, and incidentals necessary to perform the scope of work.

E. It is the intention of these specifications that the contractor provides a professional quality, complete and proper operating system in every respect and detail.

F. The installation contractor shall examine the plans in detail to familiarize him with the scope of the work.

G. The contractor shall assume full responsibility for a complete operating installation, in the required location, in accordance with the contract documents.

H. Coordinate fully with the Division 16, Stage Lighting, Structural Steel, Mechanical and all other related contractors. This Contractor shall be responsible for the proper coordination of all details of the installation

I. All work described shall be contracted to and performed by a single qualified firm as described in Section 1.6 Contractor's Qualifications.

J. All details of the installation shall be left in a finished condition, complete and ready for satisfactory operation.

K. Any discrepancies and/or omissions in the drawings and/or specifications shall in no way be construed as authority to deviate from the intent of the contract, which is to provide a complete, first quality installation of a stage rigging system.

L. Anything shown in the drawings or described in this specification shall be considered as part of both.

M. The Contractor shall be responsible for verifying all existing conditions, measurements and other data as may be required for the proper execution of the work of this contract.

N. Errors and Omissions: Any errors, omissions, or ambiguities found in these documents do not relieve the Theater Equipment Contractor of the responsibility of providing all items necessary for complete, safe, fully functional systems. Any errors, omissions, or ambiguities shall be brought to the attention of the Architect/Engineer of Record, Construction Manager, Owner, and/or Theater Consultant for clarification.

O. It is this Contractor's responsibility to ensure that the system and all of the system components, fixtures, equipment, devices, wire, terminations, field assemblies (including custom assemblies), etc. pass all required inspections by the local authority having jurisdiction.

P. Work Included: The work of this section shall include, but not be limited to the following:

1.3 WORK INCLUDED

A. Without restricting volume or generality of above "scope", work to be performed under this section shall include, but not be limited to the following:

1. Complete installation of dead hung stage rigging line sets for stage scenery, stage masking and draperies.
2. Complete installation of motorized stage rigging line sets over the stage for the stage lighting system.
3. Complete installation of motorized front of house rigging line sets for the stage lighting system.
4. Complete installation of motorized stage rigging line sets over the stage for the motorized general-purpose sets.
5. Complete installation of stage masking draperies, travelers, and tracks.
6. All necessary miscellaneous steel required to support the stage rigging equipment over stage and in the front of house.
7. Provide owner training as described herein.
8. Provide owner's manuals and as built drawings as described herein.

B. It is this Contractor's responsibility to ensure that the system and all the system components, fixtures, equipment, devices, wire, terminations, field assemblies (including custom assemblies), etc. pass all required inspections by the local authority having jurisdiction.

1.4 RELATED WORK NOT INCLUDED

A. The following related items of work, if required, are in other sections and shall not be included under this contract:

1. Structural Steel and Miscellaneous Metals, Head Block Beams, and Loading Bridges and Railings.
2. Galleries, Ladders, and Catwalks.
3. Stage lighting and electrical connections, conduit, junction boxes and wiring to power sources, control locations to the index lights and wiring to all other electrically powered devices listed in these specifications.

1.5 GENERAL REQUIREMENTS

A. Field Conditions: This project is the provision and installation of new stage rigging systems. All bidders are strongly encouraged to survey the areas where the work is to be performed prior to bidding. All bidders shall fully inform themselves of the conditions under which the work is to be performed. No additional compensation or time extension will be given for conditions of which bidder could have been fully aware prior to bid.

B. Safety: The systems shall conform to all applicable code requirements and shall be provided and installed in conformance to industry standards of operation and practices. All materials, arrangements, and procedures shall comply with applicable code requirements, allowing the end user to arrange and operate a safe assembly and working environment for audience and user's personnel.

C. Insurance: In the absence of more stringent requirements, the Theater Equipment Contractor shall maintain sufficient injury and property liability insurance coverage throughout the project's scheduled timetable, including workmen's compensation coverage for the Theater Equipment Contractor's employees.

1.6 CONTRACTOR QUALIFICATIONS:

A. Only qualified contractors shall be used.

B. The work of this section will be contracted to a single firm, referred to as the contractor.

C. This Contractor shall assume complete responsibility for the design, fabrication, transportation, and installation of the work in this Section, and shall hold the Owner, Architect, Theater Consultant, and all their Employees and Consultants harmless for any costs for errors or omissions associated with the work of this Section and any action arising there from.

D. The contractor shall be a rigging system contractor who regularly engages in the furnishing, installation and servicing of systems of similar nature, size, scope and complexity to that contemplated by this specification. The contractor shall have done so for a period of not less than five years preceding the bid date.

E. The Stage Equipment Contractor shall be a member in good standing of the Entertainment Services and Technology Association (ESTA) and maintain qualifying membership for the duration of the project

F. The contractor shall have maintained for the five years preceding the bid date, a suitably staffed and equipped service organization which has continuously offered maintenance and repair services for systems of the nature, size, scope and complexity to that contemplated by this specification.

G. The contractor shall maintain for the duration of this contract all required business and professional licenses and insurance.

H. The contractor shall demonstrate to the satisfaction of the owner, through submittals presented in accordance with the project timetable, that the contractor meets all the above qualifications. The minimum contractor qualification submittal shall include the following:

1. Statement of company history. Include a breakdown by percentage of gross sales of all business activities the contractor is involved in for each of the last 5 years (e.g., system installation = 30%, expendable sales = 40%, service = 20%, design and other professional services = 10%, etc.).
2. Previous experience: Provide a list of four installations of the type and size contemplated by these specifications, currently in use as originally installed, in which a theatre / system consultant was involved, completed in the last 5 years and the following information regarding each installation:
    a. Name and address of each installation.
    b. Facility owner and telephone number.
    c. Name, address, and phone number of a person regularly employed by the owner, who is familiar with the operation of the systems and who has no connection or business connections with the contractor except as the contractor shall fully disclose
    d. Name, address, and phone number of the theatre or system consultant, along with the names of all the consultant's personnel directly involved.
    e. System shop drawings. These will be returned if the contractor provides a call tag or return postage.
    f. Owner's manual drawings - These will be returned if the contractor provides a call tag or return postage.
    g. System-as-built drawings - These will be returned if the contractor provides a call tag or return postage.
    h. List of contractor's personnel involved with each person's responsibility on the project.
    i. Name, address and phone number of the general contractor, along with the names of all key GC personnel directly involved.
    j. Name address and phone number of the electrical contractor, along with the names of all key EC personnel directly involved.
3. Statement of current company capabilities and ownership.
4. Key Personnel. For each of the key personnel listed below; Include individual's name, title, and number of continuous years of service to contractor. Include a resume detailing industry experience, and role within organization (include only full-time/regular staff employees; not independent contractor, freelance, or temporary positions). List all industry certifications held, training courses attended, and continuing education credits, including dates of attendance. List recently completed projects, scope of project, and completion dates.
    a. Project Manager
    b. Senior Technician
    c. Service Manager
5. Other Department Staff. Include size of staff and experience of each staff member.
6. Replacement and Spare Parts Inventory – Provide detailed list of primary replacement parts, components, and spares typically held in inventory.
7. Test Equipment and Physical Plant – Include an inventory of all test facility equipment owned and used regularly by the Service Department. Provide description of physical plant and space utilization.
8. Copies of all business and professional licenses and insurance certificates.

I. For purposes of this contract, Dealers, Jobbers, and Sales Representatives SHALL NOT be considered as eligible participants.

J. Without prejudice to others, the following contractors are considered qualified and do not need to submit contractor's qualifications:

InterAmerica Stage, Inc.
4300 St. John's Parkway
Sanford, FL 32771
(407) 302-0881
Contact: Mark Black

Mainstage Theatrical Supply, Inc.
8761 A Ely Dr.
Pensacola, FL 32514
Tel: 850-434-2080
Fax: 850-434-6046

Miami Stagecraft/ S.E.A.L. a Solotek company
12250 NE 13th Ct.
North Miami, FL 33161
(305) 891-1000
Contact: Steve Welsh

1.7 SUBMISSIONS

A. A. Drawings:

1. Submit plans, elevations, sections, and equipment schedules to the Architect of all systems, components, installation methods, and schedules showing all information necessary to fully explain the design features, appearance, function, fabrication, load ratings, installation and use of system components in all phases of operation.
2. All drawings shall be prepared under the direct supervision of, and sealed by, a Professional Engineer licensed in the state of Florida, and familiar with the design and installation of stage equipment.
3. The drawings shall be no less detailed than as provided in the contract documents.
4. System plans, elevations, and sections shall be submitted on minimum D-size (24x36) sheets and shall be drawn in no less than 1/4" =1'-0" scale.
5. Submit in quantities as required by the Architect.

B. Catalog Cuts: In lieu of detailed equipment drawings, the Theater Equipment Contractor may submit catalog cuts for standard, unmodified equipment.

1. All catalog cuts shall contain full information on dimensions, construction, applications, load ratings, etc., to permit proper evaluation.
2. Catalog cuts shall be properly identified as to their intended use. Any options or variations shall be clearly noted.
3. Detailed drawings of any modified standard equipment shall be submitted for approval as described in Section 1.7.A.
4. Catalog cut sheets shall be prepared and bound in a professional manner, with each sheet properly indexed to a "Table of Contents". Loose or stapled sheet sets are not permitted.
5. All copies of catalog cut sheets must be clear and legible.

6. Submit in quantities as required by the Architect.

C. Samples: Provide samples of all fabrics and color choices for selection and approval. Hardware or component samples shall be provided upon written request. Submit in quantities as required by the Architect

D. Approvals: All submissions must be approved per the requirements of the project's general conditions prior to the beginning any fabrication, installation, or erection. Such approval does not relieve the Theater Equipment Contractor of the responsibility of providing equipment in accordance with the specifications or of providing fully operational and safe systems.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All materials and equipment shall be furnished in the quantities needed to complete the scope of work.

B. All materials and equipment used in this project shall be new, unused and of the latest models and design. Refurbished materials and equipment are not permitted.

C. Any item of equipment or hardware that may not be specifically shown on the drawings or specified herein but required for proper system operation or installation shall be furnished and installed and be of the highest quality available.

D. Prior to fabrication of materials, the Contractor shall visit the site and measure for the exact fit of all materials and assure themselves of the appropriateness of the materials.

E. Shop and field welding techniques used shall be those described by the appropriate sections of "Specifications for Design, Fabrication and Erection of Structural Steel for Buildings", of the American Institute of Steel Construction, 6th Edition.

F. Painting: All steel rigging components shall be cleaned of rust, scale and any foreign matter. Finish paint color shall be Flat Black.

G. Machining and Finishing: Operating parts of all rigging equipment shall be suitably machine finished. Tolerances and fit and finish, where not specified, shall conform to good trade practices.

H. UL Labels: All equipment, where applicable standards have been established, shall be listed by Underwriters' Laboratories, Inc., and shall bear UL label when delivered to the job.

I. If so required by the local authority having jurisdiction, anything not arriving at the job bearing a UL label shall be field inspected and label by a nationally recognized testing laboratory recognized and approved by the local authority having jurisdiction.

J. Recommended Working Load: This specification calls for minimum recommended working loads for many hardware items. The manufacturer's recommended working load is the maximum load which the manufacturer recommends is applied to properly installed, maintained, and operated new equipment. Manufacturer's recommended working loads shall

be determined by calculations by a Licensed Professional Engineer and destructive testing by an independent testing laboratory. These calculations and reports shall be available for review.

K. All moving parts shall have specified tolerances. Sheaves shall run plumb and true and shall not scrape housings.

L. Where dimensions and loading capacities have been omitted from this specification, they are to be determined by the bidder in accordance with accepted industry standards and the guidelines in this section. In no way shall the Stage Equipment Contractor be relieved of the primary responsibility to provide a safe, fully functional system.

M. All equipment shall be built and installed to facilitate future maintenance and replacement.

N. The mechanical fabrication and workmanship shall incorporate best practices for good fit and finish. There shall not be any burrs or sharp edges to cause a hazard nor any sharp corners accessible to personnel.

O. All finishes which are disturbed during shipping and installation shall be touched up to match the original.

2.2 APPROVED MANUFACTURERS

A. Due to their interrelated design, all the stage equipment in this specification shall be supplied by one qualified stage rigging manufacturer who shall be responsible for coordinating the required design and installation details

B. One approved stage drapery manufacturer shall supply all Draperies in this specification.

C. In general, the component units have been described in detail in order to obtain the required performance. The specifications are minimum requirements, and in no case will items of lesser design be acceptable. Only components that in the opinion of the Architect upgrade the unit in all ways will be considered. Manufacturers' standard off-the-shelf components will not be considered unless they meet the minimum specifications.

D. The use of "brand names" has been held to a minimum in these specifications and when used are to establish a quality and performance standard. Items by other manufacturers not included in the Approved Manufacturers list may be used after written approval has been obtained from the Architect.

E. Substitutes shall be considered only when they are submitted fourteen days prior to bid date, and are accompanied by sufficient drawings, catalog data, specifications, and technical information for evaluation.

F. The following are approved automated theatrical rigging manufacturers:

J.R. Clancy, Inc.
7041 Interstate Island Road
Syracuse, New York 13209
(315) 451-3440

InterAmerica Stage, Inc.

4300 St. John's Parkway
Sanford, FL 32771
(407) 302-0881
Contact: Mark Black

Mainstage Theatrical Supply, Inc.
8761 A Ely Dr.
Pensacola, FL 32514
Tel: 850-434-2080
Fax: 850-434-6046

Texas Scenic
5423 Jackwood Drive
San Antonio, TX 78238
(800) 292-7490
Contact: Michael Gonzales

G. The following are approved stage rigging equipment manufacturers:

J.R. Clancy, Inc.
7041 Interstate Island Road
Syracuse, New York 13209
(315) 451-3440

Peter Clark Inc.
5204 Highgreen Court
Colfax, North Carolina 27235
(336) 370-4896

H&H Specialties
2203 Edwards Avenue
South El Monte, CA 91733
(800) 221-9995

Mainstage Theatrical Supply, Inc.
8761 A Ely Drive
Pensacola, FL 32514
(850) 434-2080
Contact: Ken Leichhardt

InterAmerica Stage, Inc.
4300 St. John's Parkway
Sanford, FL 32771
(407) 302-0881
Contact: Mark Black

H. The following are approved stage drapery fabricators:

Rose Brand
75 Ninth Avenue
New York, New York 10011
(212) 242 7554

Stage Decoration and Supplies
3519 Associate Drive
Greensboro, North Carolina 27405
(336) 621 5454

I Weiss and Sons, Inc.
2-07 Borden Avenue
Long Island City, New York 11101
(718) 706 8139

Gerriets International
29 Hutchinson Road
Allentown, New Jersey 08501
(800) 369 3695

I. The following are approved sources for stage drapery material:

K-M Fabrics
2 Waco Street
Greenville, South Carolina
(864) 295 2550

Dazian
124 Enterprise Ave. So.
Secaucus, New Jersey 07094
(201) 549 1000

Gerriets International
29 Hutchinson Road
Allentown, New Jersey 08501
(800) 369 3695

J.B. Matrin Ltee
445 St-Jacques
St-Jean-sur-Richelieu, Quebec J3B 2M1
(450) 346 6853

J. The following are approved curtain track manufacturers:

Automatic Devices Company
2121 South 12th
Allentown, Pennsylvania
(800) 360 2321

H&H Specialties
2203 Edwards Avenue
South El Monte, CA 91733
(800) 221-9995

2.3 CONSTRUCTION STANDARDS:

A. Construction of all rigging component parts shall meet the following minimum standards:

B. Materials shall conform to the following ASTM and ANSI standard specifications:
1. A-36 - Specification for structural steel
2. A-47 - Specification for malleable iron casting
3. A-48 - Specification for gray iron casting
4. A-120 & A-53 - Specification for black and hot-dipped zinc-coated (galvanized) steel pipe for ordinary use
5. B18.2.1&2 - Specification for square and hex bolts and nuts

C. In order to establish minimum standards of safety, the following factors shall be used:
1. Overall minimum safety factor for all rigging and related components: 8.
2. Cables and fittings - 8:1 Safety Factor
3. Cable bending ratio - Sheave tread diameter minimum 30 times cable diameter
4. Tread Pressures:
   a. 500 lbs. for cast iron
   b. 900 lbs. for Nylatron
   c. 1000 lbs. for steel
5. Maximum fleet angle - 1-1/2 degrees
6. Steel - 1/5 of yield
7. Bearings - Two times required load at full speed for 2000 hours
8. Bolts - Minimum SAE J429 Grade 5 (ISO R898 Class 8.8), zinc plated
9. Motors - 1.0 Service Factor
10. Gearboxes - 1.25 Mechanical Strength Service Factor

D. Sheaves shall be of the following materials, as specified:
1. ASTM A-48 Class 30 grey iron castings
2. Cast Nylatron GSM
3. Injection molded Nylatron GS.
4. Steel
5. Groove depths shall be sufficient to encompass fully the cables and ropes. Grooves shall have sloped sides (8 degree minimum) and conform to rope and cable manufacturers' standards for groove shape and tolerance.
6. Sheaves shall be supported by bearings and a machined steel shaft, which shall be keyed to one side plate to prevent rotation. Proper adjustment of the bearing shall be accomplished by means of a fine thread, self-locking nut on the opposite end of the shaft. Each sheave shall run plumb and true without rubbing its side plates when rotated.
7. Custom side plates are required. Field measurements must be taken before manufacturing loft blocks and head block.

2.4 NEW STAGE RIGGING SYSTEM COMPONENTS

A. General: The following listing is provided as a general guide to the major components required for this project. It is not intended to be a complete listing of all equipment and components required to provide fully functional systems. Materials, fabrication, and installation shall be as shown in the drawings and as specified herein. The Theater Equipment Contractor is solely responsible for providing all items necessary for complete, safe, fully functional systems that meet the intent of these specifications.

B. Bills of Materials

1. Provide motorized rigging line sets for use with the stage lighting electrics. Coordinate design and installation of lighting distribution and stage lighting cable handling system with electrical contractor and stage lighting contractor. Each set shall be made up of (but not limited to) the following components:
   a. 2,000 lb. capacity electrically powered line shaft hoist
   b. 1 ea. Motor.
   c. 1 ea. Pantograph (furnished by with stage lighting contractor).
   d. 4 ea. 1/4" lift line cables and lift line terminations.
   e. 1 lot Pipe clamps & turnbuckles.
   f. 2 ea. For electrics 1 ½" ID schedule 40 pipe batten in lengths as shown on the drawings.
   g. Provide in quantities as shown on contract drawings.
   h. Basis of design is J R Clancy Power Line Hoist

2. Provide motorized rigging line sets for use with the motorized general-purpose line sets. Coordinate design and installation of lighting distribution and stage lighting cable handling system with electrical contractor and stage lighting contractor. Each set shall be made up of (but not limited to) the following components:
   a. 2,000 lb. capacity electrically powered line shaft hoist
   b. 1 ea. Motor.
   c. One multi-cable cable cradle (furnished by with stage lighting contractor).
   d. 7 ea. 1/4" lift line cables lines and lift line terminations.
   e. 1 lot Pipe clamps & turnbuckles.
   f. 1 ea. 1 ½" ID schedule 40 pipe batten in lengths as shown on the drawings.
   g. Provide in quantities as shown on contract drawings.
   h. Basis of design is J R Clancy Power Line Hoist

3. Provide and install dead hung line sets per drawings and schedules for use with stage masking legs, borders, CYC electric, and travelers, as shown on the drawings. Each set shall be made up of, but not limited to:
   a. 1 lot beam clamp assemblies
   b. 1 lot 1/4" lift line cables lines and lift line terminations, as shown in the drawings.
   c. 1 lot trim chain terminations, as shown on the drawings
   d. 1 1/2" ID sch. 40 pipe batten, in lengths as shown in the drawings and schedules.
   e. Cyc electric line set shall have pipe clamps & turnbuckles.
4. masking legs, borders, CYC electric, and travelers.
5. Provide and install system signage as specified herein.
6. Provide the following miscellaneous items:
   a. 1 lot Stage draperies per drawings, schedules and specifications
   b. 1 lot Drapery tracks per drawings, schedules and specifications

2.5 MOTORIZED LIFT LINE SHAFT WINCH LINE SET

A. General Description: Furnish and install fixed speed motorized line shaft winch straight lift hoists (2,000 lb. capacity) for use with the motorized stage lighting electrics, front of house motorized stage lighting electrics and the motorized general purpose line sets in the quantities and locations as shown on the construction documents and specified herein.

B. Special Conditions: It is the intention of this specification for the contractor to provide fully functioning fixed speed motorized line sets to be used with the stage lighting electrics and motorized general purpose line sets. Actual equipment and components must reflect building conditions and approved construction drawings. All dimensions must be field verified by the Stage Rigging Contractor.

Conditions detailed in the drawings, which may not be covered in these specifications, shall determine actual equipment needs.

C. Battens:

1. Pipe battens over stage shall be approximately 62'-0" long
2. Pipe battens over the auditorium shall be approximately 35'-0" long
3. Line Set pipe battens shall be constructed from 1-1/2" inch I.D., Schedule 40, Black iron pipe.
4. Pipe joints shall be minimized.
5. All joints shall be spliced with 18" long drive fit pipe sleeve with 9" extending into each pipe and held by two hex bolts and lock nuts on each side of the joint.
6. All pipe joints shall be positioned near a pick-up point.

D. Lift Cables:

1. All lift cables shall be 7 x 19 construction, galvanized aircraft cable, sized as required, and with breaking strengths as follows:
   a. 1/8" diameter (3mm) - 2,000 pounds
   b. 3/16" diameter (5mm) - 4,200 pounds
   c. 1/4" diameter (6.5mm) - 7,000 pounds
   d. 5/16" diameter (8mm) - 9,800 pounds
   e. 3/8" diameter (9.5mm) - 14,400 pounds
2. Damaged or deformed cable shall not be used. All wire rope rigging shall be installed so as to prevent abrasion of the wire rope against any part of the building construction or other equipment

E. Cable Terminations:

1. The pipe end of each cable shall be attached to the batten using a drop forged type 3/8" x 6" (9.5mm x 152mm) turnbuckle installed at the batten end attached to an appropriately sized pipe clamp or ¼" proof coil chain for more information see construction drawings.
2. Lift cables may be terminated by swaged compression fittings
3. Swaged sleeve fittings shall be cooper "Nicopress" type
4. Swaged fittings shall be installed per the fitting manufacturer's instructions, using the appropriate tools, and checked with a "Go - No go" gauge.
5. All cable termination points shall be finished with cable thimbles "eyes".
6. Eyes shall be formed over wire rope thimbles of correct sizes.
7. All shackles and turnbuckles shall be "moused."
8. All cable ends shall be taped to prevent snagging

F. Gear motor:

1. Motor, primary brake and gearbox shall be an integrated unit, with the first stage pinion gear mounted directly on the motor's armature shaft. No couplings will be permitted between the motor and gear reducer. Exceptions will be permitted only when special gearing or torque requirements cannot be met with an integrated unit.
2. Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum AGMA service factor of 1.0 for constant operation.
3. The gear reducer shall be a combination Helical/Worm reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) shall have triple lip oil seals to prevent leaks. The gearing service factor shall be a minimum of 1.0 with a mechanical strength service factor of 1.25.

G.

H. Primary Brake:

1. The primary brake shall be an integral part of the motor, mounted directly on the motor's armature shaft. No couplings will be permitted between the motor and primary brake.
2. Brake shall be spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200% of motor full load torque.
3. The brake shall be released by energizing the coil simultaneously with the motor winding to provide fail-safe breaking in case of power failure. All cable ends shall be taped to prevent snagging.

I. Bearings:

1. Bearings shall be selected to accommodate the applied loads and speeds.
2. The use of self-aligning flange bearings is preferred. The use of other bearing types shall be in accordance with good engineering practice. Pillow blocks may be used only where they are subject to compressive forces only.

J. Helical Drums:

1. Winding drums shall be designed to properly support the required loads.
2. Drums shall be helically grooved to accept a single layer of cable accommodating the entire travel distance plus three dead wraps. The drum diameter shall meet or exceed the wire rope manufacturer's minimum recommended D/d ratio.
3. Drum construction shall be of the all welded type. Cables shall enter the drum through holes drilled from root of the cable groove through the tubing wall at a 45 degree angle and shall be retained by a Nicopress™ stop sleeve.
4. Appropriately sized steel side plates at each end of the drum shall support drums. Each side plate shall contain a self-aligning flange bearing to support the drum and shaft.
5. The cable drum must be of proper length to hold all of the cable in one layer; rope piling is not acceptable.
6. The drum hub must be keyed directly to the output shaft of the reducer.
7. Chain or belt drives are not acceptable

K. Winch Frame:

1. The winch frame must be constructed of structural steel members, compactly designed to support the winch and load in a minimum amount of space
2. Structural support must run continuously for the entire length of the system.
3. In the winch frame must be incorporated a cable keeper bar that is located next to the grooves to prevent lines from jumping grooves and slack lines from unwinding.

L. Rotary Limit Switches:

1. Rotary limit switch assemblies shall have two or four independently adjustable switch/cam sets as required. A geared assembly shall drive the cams.
2. Switches shall have snap acting contacts.
3. Rotary limit switches shall be driven directly or by roller chains. If roller chains are used, sprockets shall be pinned to prevent slipping and sized for maximum usable rotation of switch cams. The input shaft and drive chain shall be fully guarded.
4. Switches shall be mounted to the winch base to allow for easy adjustment of the switch settings.

5. Rotary limit switches shall be General Electric CR115E series.

M. Fixed Speed Starters:

1. A full voltage, reversing UL Listed starter, shall control each fixed speed winch. Enclosure shall be NEMA 12 with hinged, latching cover. The interior of the starter cabinet shall be "touch safe" per IEC 204-1 "Protection against direct contact" rules.
2. The NEMA/IEC, magnetically operated, mechanically and electrically interlocked; reversing starter shall be sized to match the winch motor horsepower and shall be rated for plugging and jogging. An IEC Class 10 (Bi-metallic) thermal overload relay shall be provided sized to trip at 115% of the motor's "Full Load Amps".
3. A separate line contactor shall be provided, controlled by the E-stop and over travel limit switches, to provide a redundant means of removing power from the winch.
4. Starters shall be wired so that operation of the normal end of travel limit switches shall only allow movement away from the limit switch. Operation of an over travel limit switch shall open the line contactor and will not allow any further movement in either direction.
5. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the over travel limits for resetting purposes.
6. Each starter shall be provided with fuses properly sized per UL 198C guidelines or circuit breakers for primary motor protection. Provide a control circuit transformer with properly sized primary and secondary fusing. Properly labeled, screw clamp terminals shall be provided for all field connections.

N. Eight Channel Fixed Speed Control Station:

1. The control station shall be a wall mounted NEMA 1 enclosure, containing a hold to operate (dead man) Up and Down pushbuttons. A key operated On / Off switch shall be provided. A red, mushroom head emergency stop pushbutton shall be provided, which directly controls the line contactor in the starter.
2. An indexed motor select knob to select hoist.
3. Panel components (pushbuttons, key switches, switches, indicators, E-stop switches, and the like) shall be industrial grade, heavy-duty components with 7/8" (22 mm) operators.
4. Panel components shall be Telemecanique ZB series or Allen Bradley Bulletin 800MR.

2.6 DEAD HUNG RIGGING EQUIPMENT SPECIFICATIONS

O. Trim Chains:

1. Trim chains shall be 36" long, made of 1/4" plated, grade 30 Proof Coil chain. Connection between the end link and the lifting cable shall be made with a thimble and copper Nicopress sleeve. Chains shall be wrapped one and one half turns around the batten and attached back to the thimble at the end of the lift line with a ¼" forged shackle. Adjustment is made by connecting the shackle into a link along the return side of the chain.
2. Trim chains shall have a recommended working load of at least 750 lbs.

P. Lift Cables:

1. All lift cables shall be 7 x 19 construction, galvanized aircraft cable, sized as required, and with breaking strengths as follows:

a. 1/8" diameter 2,000 pounds
b. 3/16" diameter 4,200 pounds
c. 1/4" diameter 7,000 pounds
d. 5/16" diameter 9,800 pounds
e. 3/8" diameter 14,400 pounds

2. Damaged or deformed cable shall not be used. All wire rope rigging shall be installed so as to prevent abrasion of the wire rope against any part of the building construction or other equipment.

Q. Cable Fittings:

1. Swaged sleeve fittings shall be copper Nicopress™. Swaged fittings shall be installed per the fitting manufacturer's instructions, using the appropriate tools, and checked with the appropriate Nicopress™ "Go - No go" gauge. Clamp type "cable clips" shall not be permitted.
2. Eyes shall be formed over galvanized wire rope thimbles of correct size.
3. Exposed cable ends shall be sealed in black heat-shrink tubing.

R. Turnbuckles: Turnbuckles shall be drop forged and galvanized, and conform to ASTM F-1145 Type 1, Grade 1. Turnbuckles shall be moused after adjustment to prevent loosening.

S. Beam Clamp:

1. Beam clamps shall have two 7-gauge, painted steel plates punched to grasp a beam flange. Each plate shall have multiple holes to allow adjustment for a range of flange sizes.
2. Clamps shall be complete with two 3/8" x 1" hex bolts with lock nuts, and a 1/4" round pin anchor shackle.
3. Beam clamps shall have a recommended working load of at least 350 lbs.

T. Pipe Battens:

1. All battens shall be 1-1/2" nominal inner diameter, Schedule 40 black iron pipe in lengths as shown on the drawings.
2. All joints shall be spliced with 18" long sleeves with 9" extending into each pipe and held by two 3/8" dia. x 2 1/4" long hex bolts and low profile jam lock nuts on each side of the joint. Welded connections are not permitted. Any gap between pipe sections shall not exceed ¼".
3. Each end shall be covered with a bright yellow, closed end, soft vinyl safety cap at least 4 inches in length.
4. Pipe battens shall carry set numbers and centerline indicator marks as specified in Section 2.7

2.7 EQUIPMENT LABELS AND MARKINGS

A. Pipe Battens:

1. Provide minimum 1½" tall field applied white set number labels at the underside of each pipe at each end, just onstage of the plastic end caps. Hand numbering is not permitted.
2. Provide a 1" wide yellow enamel paint stripe at the stage centerline.

3. Provide a 1” wide stripe at each side of the trim chains where located on the batten when the lift cables are perfectly plumb.

2.8 STAGE DRAPERY TRACKS

B. Heavy Duty Box Tracks (Auditorium Stage Traveler Tracks)

1. ALL TRACK AND COMPONENTS SHALL BE PROVIDED WITH BLACK FINISH. Drapery tracks shall be of 14 gauge black painted galvanized steel, entirely enclosed except for slot in bottom, each half to be in one continuous piece except where splicing clamps are required. Aluminum track is not acceptable for this project.
2. Each drapery carrier shall be spaced on 12" centers and shall be of steel construction with two nylon-tired ball-bearing wheels held to steel body by rustproof nickel plated rivet, such wheels rolling on two separate parallel treads. Each drapery carrier shall consist of a free-moving plated swivel and sufficient trim chain to accommodate drapery snap hook.
3. Live-end pulley and Dead-end pulley blocks shall be adjustable and shall be equipped with minimum 5" diameter sleeve-bearing wheels adequately guarded.
4. A rubber bumper shall be attached to each drapery carrier to function as noise reducer.
5. The manufacturer shall furnish two end stops for placement at each track end and a minimum 5” diameter tension floor pulley for increasing cord tension.
6. Provide the floor pulley with a demountable floor plate. Install floor plate flush into the stage floor as required.
7. Stretch-resistant operating cord shall be black and have a synthetic or wire center and shall be minimum 3/8" diameter. Machine operated tracks shall be supplied with a 3/16” wire center operating cable.
8. Provide “Back-pack” devices for all cord operated track assemblies.

C. Heavy Duty Box Tracks (Auditorium Stage Back Drop Walk Along Tracks)

1. ALL TRACK AND COMPONENTS SHALL BE PROVIDED WITH BLACK FINISH. Drapery tracks shall be of 14 gauge black painted galvanized steel, entirely enclosed except for slot in bottom, each half to be in one continuous piece except where splicing clamps are required. Aluminum track is not acceptable for this project.
2. Each drapery carrier shall be spaced on 12" centers and shall be of steel construction with two nylon-tired ball-bearing wheels held to steel body by rustproof nickel plated rivet, such wheels rolling on two separate parallel treads. Each drapery carrier shall consist of a free-moving plated swivel and sufficient trim chain to accommodate drapery snap hook.
3. Two rubber bumpers shall be attached to each drapery carrier to function as noise reducer.
4. Furnish two end stops for placement at each track end.
5. Each track shall have pull lines installed on the last carrier at each end of the track.

D. Pipe Batten Clamps (Auditorium Stage):

1. All drapery tracks shall be suspended below their respective pipe batten by rigid pipe clamps. Under no circumstances shall hanging chains or other methods be used.
2. Pipe clamp supports shall be installed at a maximum spacing of 4’-0” on center.
3. Pipe clamps shall be made of two strips of 12 Ga. by 2" hot rolled steel formed to encompass and clamp the pipe batten to prevent its rotation. Corners shall be rounded.

4. There shall be a 3/8" x 1" hex bolt with lock nut above and below the batten. A 5/8" hole in the bottom of each clamp half shall allow for the attachment of the track hangers.

2.9 STAGE DRAPERIES AND RELATED WORK

A. Fire Prevention

1. All fabrics and materials used in this installation shall be inherently flameproof to render them flame retardant in accordance with all applicable regulations and life safety codes.
2. An original, signed and notarized certificate of flame retardant treatment shall be executed and presented to the Owner for each fabric prior to installation.
3. A permanent label shall be affixed to each curtain stating:
   a. The name, address and telephone number of the manufacturer
   b. The name, address, and telephone number of the contractor
   c. The item name (leg, border, main drape, etc.)
   d. The face finished dimensions of the piece
   e. The flame proofing certification minimums complied with
   f. Cleaning and maintenance instructions needed to retain flame retardant characteristics
   g. The timetable for re-treatment when appropriate
   h. The fire retardant re-treatment process to be used
4. The flame retardant treatment shall not contribute to the aging or deterioration of the material in any way.
5. The flame retardant treatment shall not cause staining or color transfer from one material to another or at any time form visible crystals or striations or in any other way affect the integrity of the material.
6. Provide a three 24” x 24” swatch for each different type of fabric from the same lot as the pieces on site for future testing. One set of swatches shall be pinned to the rear of the drapes on site at the time of inspection. The other two shall be included in the Owner’s Manuals that are turned over to the owner. Each test swatch shall be labeled as called for above.

B. General Construction Standards

1. Fabrics shall be first quality throughout. No “seconds” or off standard materials shall be accepted.
2. All materials of the same type and color shall be from the same dye lot and from the same basic product manufacturer.
3. All fabric runs shall be full height with no horizontal seams, except as noted.
4. All pile fabrics or materials with a 'run' or 'lay' shall have a pile running down.
5. All drapery as removed from bolts shall be tabled across an inspection window for detecting flaws and imperfections
6. All flaws shall be cut out and not incorporated in the finished work.
7. Thread colors shall match face fabric colors.
8. All thread ends and stitch terminations shall be securely finished so as not to ravel in rough handling.
9. All drapery edges shall hang plumb within 2” of vertical.

C. Fullness:

1. Fullness shall be in addition to all allowances for hems and turn backs and other basic construction details.

D. Pleats:

1. Pleats shall be box type on 12" centers.
2. Drapes called for to be pleated shall be pleated such that vertical seams are included in the pleats and fall in the upstage curvature of fabric folds.

E. Top Finish:

1. All draperies shall be reinforced with 3-1/2" heavy-duty jute webbing
2. All draperies shall be double stitched to the top 2 ¾" apart with 1 inch of face fabric turned under.
3. Centerline of each piece shall be clearly marked on the jute webbing.

F. Grommets, Tie Lines, and S-Hooks:

1. All grommets shall be #3 brass and machine set.
2. All pleated curtains shall have brass grommets inserted in pleat centers.
3. Each upper corner of each traveler section shall have double grommets precisely arranged to fit double chains of master carriers regardless of whether drapery section is used right or left stage.
4. All un-pleated curtains shall have brass grommets inserted 9 inches on centers.
5. All curtains mounted to prime pipes shall be supplied with 36" #4 braided cotton tie lines, black in color, installed in the drape.
6. A single opposing color tie line shall be supplied at the center point of each drape.
7. All curtains mounted to traveler tracks shall be supplied with the appropriate S-hooks and all necessary accessories.

G. Bottom Hems:

1. Prior to sewing the bottom hem, the otherwise completed drape shall be hung full height to their finished width and allowed to hang untouched for two weeks.
2. All materials sewn with fullness shall have 6" bottom hems with separate interior canvas chain pocket
3. All chain pockets shall be stitched so that the chain will ride 2" above the finished bottom edge of the curtain.
4. All materials with chain pockets shall be supplied with #8 plated jack chain or equivalent.
5. Lead tape or other toxic substances shall not be incorporated into any drapery in this section.
6. All materials sewn without fullness shall have 6" bottom hem with a separate interior canvas pipe pocket unless otherwise noted in this spec or on the curtain & track schedule.
7. All pipe pockets shall be stitched so that the pipe will ride 2" above the finished bottom edge of the curtain.
8. All materials with pipe pockets shall be supplied with 3/4" ID schedule 40 pipe coupled in 10' sections.

H. Side Hems:

1. Leading edges of all travelers shall have ½ face width turn backs.
2. Scrim and Cyclorama shall have side hems of 4".
3. All other side hems shall be 2".

I. Dimensions: All dimensions given in this specification are "face finish" and do not include allowance for fullness and hems.

J. Acceptable fabrics shall be:
1. IFR Velour:

a.	KM Fabrics	Prestige and Encore
b.	Dazian	Allure
c.	Gerriets	Clivia 54 and Porza 54
d.	J.B. Martin	Ovature
e.	Rose Brand	Chrisma

K. Leno Filled Scrim

a.	Dazian	Filled Scrim (Leno filled scrim)

L. Furnish, deliver and install in quantities and size required to complete this job as shown on the drawings, related drapery schedules, and as specified herein:

M. Field verify dimensions prior to fabrication.

2.10 SYSTEM SIGNAGE

A. System Sign: Provide and install one (1) system informational signs. The signs shall be installed at the downstage left area in sight of the hoist control. The sign shall describe the following:

1. Maximum hoist capacities
2. Maximum load at single lines (i.e., loft block locations)
3. Name, address, and phone number of installation contractor
4. Name, address, and phone number of equipment manufacturer
5. Date of installation (month and year)
6. Statement - “Stage rigging system must be inspected yearly by qualified personnel”

B. Operational Warning Sign: Provide and install one (1) sign at the downstage left area in sight of the hoists controls stating “STAGE RIGGING OPERATION BY AUTHORIZED AND TRAINED PERSONNEL ONLY” in minimum 1-1/2” high lettering.

C. Sign Materials and Lettering size:

1. Signs shall be of minimum 3/16” thick red non-glare plastic.
2. Lettering shall be white in color in a non-serif font, such as Helvetica or Arial, in ALL CAPS, and in font sizes as specified herein.
3. Signs shall be mechanically affixed to the walls within sight of the hoist control. Glued applications are not permitted.
4. Signs shall be professionally produced. No hand or “stick on” lettering is permitted.

PART 3 - EXECUTION

3.1 GENERAL

A. Fabricate and install items in conformity with applicable trade practices and manufacturer's

recommendations, unless specifically excepted by Specifications or Drawings

B. Carry out shop and field welding in full conformity with applicable AISC, ASME, AWS and ASA standards.

C. Comply with local codes. In absence of local codes, comply with AISC, NEC, and ASA standards as applicable.

D. Furnish, turn over to Owner's designated representative and obtain receipt for all spare parts and equipment required as part of this project.

E. Workmanship and finish must be first class in every particular and strictly in accordance with the best practices. Work shall be made in accordance with the reviewed shop drawings. Work made in sections shall be carefully fitted together. Units shall be properly laid out and spaced between terminals.

F. Only experienced riggers shall be used on the work and a supervisor carrying an ETCP Certification in Theatrical Rigging shall be present during the entire installation.

G. An experienced, qualified representative of the rigging hardware and drapery manufacturer shall be present at all times during the installation

H. The entire installation shall be made with the assistance of the factory-authorized representative of the equipment manufacturer. The equipment manufacturer's recommendations and instructions are to be fully implemented.

I. Storage: The Contractor shall be responsible for storage of stage equipment, tools, and its equipment during the period of the installation.

J. Damage Protection: The Stage Rigging Contactor shall take all precautions necessary to prevent damage to the stage floor, walls, and all other existing finishes during installation

3.2 SHOP DRAWINGS AND SUBMITTAL

A. Within thirty (30) days of bid award and prior to beginning work, prepare and submit shop drawings to the Architect for approval. These drawings shall be detailed and complete on all phases of the installation. The drawings shall include details of all rigging hardware components. Shop drawings shall be approved by the Architect prior to fabrication, installation or erection have begun. Minimum plates required shall be:
   1. Title sheet
   2. Scale plan and section drawings
   3. Scale elevation drawings of each line set type included (fire curtain, gp sets, electric sets, etc.)
   4. Assembly drawings of all major components including dimensions, weights and bill of materials
   5. Electrical riser, interconnect and block diagrams
   6. Scale drawings of all electrical and control system components, complete assemblies and control stations
   7. Scale location drawings of all electrical components required (both those provided by the rigging contractor and those provided by the electrical contractor). This drawing shall be used by the electrical contractor to coordinate the electrical “rough in” and correct placement is the responsibility of the rigging contractor

B. Approval of shop drawings does not relieve the Contractor of the responsibility of providing equipment in accordance with these specifications. Any deviations from the specifications shall be "starred" and noted in 1/4" high letters. Only deviations which upgrade the quality of the equipment shall be considered.

C. Individual components shall be detailed as required to illustrate materials, thicknesses, sizes, capacities and methods of assembly or attachment to adjoining components.

D. Shop drawings shall show all system loads, safety factors, system capacities and imposed building loads.

E. Specific notes shall be included pertaining to the adequacy of the related structural steel, miscellaneous metals and electrical accommodations as they appear on the contract drawings

F. Shop drawing shall be fully coordinated with all other disciplines and site data and dimensions

G. Included with the shop drawings shall be a submittal package including:
1. Complete color selection samples of curtain materials for Architect's selection.
2. Catalog information and cut sheet of all standard equipment
3. Catalog information and cut sheets of all electrical components
4. Owner's manuals for everything electrical in nature and any complex mechanical machinery (e.g., winches)
5. Complete drapery and curtain track information and cut sheets
6. The required flame retardant certifications from the Drapery section of this specification.

H. Shop drawing and submittals shall be revised and resubmitted as required.

3.3 FABRICATION

A. Machine finish operating parts to standard trade tolerances, fits, and finishes, unless otherwise specified.

B. Paint all fabricated work flat black unless specified on the drawings or herein.

3.4 JOB CONDITIONS

A. Take required measurements at the building. Consult with the various other Contractors whose work adjoins this work. This Contractor shall be responsible for the proper coordination of all details of the installation.

B. Do drilling and fitting and work of similar character required in the fitting and setting of the materials in place and do cutting and fitting required in connection with the fitting of these materials to the adjoining work of other Contractors.

C. Provide connecting members needed for properly supporting and securing the work to the masonry, joints, walls, structural members, or other parts of the building as may be best suited for each case.

3.5 INSTALLATION

A. Position items accurately as indicated on Drawings and true to plumb line and level.

B. Use fittings and clips conforming to cable manufacturer's recommendations as to size, number, and method of installation.

C. Form rope and cable eyes over properly sized thimbles at requisite connection points.

D. Do required cutting, drilling, tapping, and welding necessary to properly install work.

E. Consult and coordinate work with trades doing adjoining work.

F. Install all rigging components to maximize batten travel.

G. Provide completed installation, ready for satisfactory operation, prior to tests and inspection. Advise the Architect in writing that the installation is so completed and ready for acceptance tests and inspection.

H. Adjust hand line lengths for proper tension block take up after initial stretch of line.

I. Curtains are to be installed on their proper tracks and battens and trimmed to the floor in the best manner known to the profession.

J. Installation practices:

1. Installation practices shall be in accordance with Federal OSHA Safety and Health Standards and all local codes. Certified welders shall perform all field welding in full compliance with the latest edition of the Structural Welding Code (ANSI/AWS D1.1) and any other applicable local and state codes and regulations.
2. Equipment shall be installed in a workmanlike manner, per plans and specifications. Equipment shall be aligned, adjusted, and trimmed for the most efficient operation, the greatest safety and for the best visual appearance.
3. Field Welding: All proposed field welding shall be described and submitted in detail in the form of sketches and/or drawings for review by the Architect/Engineer of Record/Engineer of Record.
4. Touch-Ups: Any welds or cuts shall be touched up to match disturbed finishes. All finishes which are disturbed during shipping and installation shall be touched up to match the original.

3.6 INSPECTION

A. The job will be inspected periodically by the Architect and/or his representative while work is in progress, and the Contractor shall accord his full cooperation in the examination of work and materials, which may include dismantling of the equipment for examination of component interior parts. Any equipment found not meeting the specification shall be removed immediately from the job.

B. Arrange for the Consultants inspection of the system. Upon completion of the Consultants punch list, arrange for demonstration of the system by the manufacturer's designated representative at a time acceptable to the Consultant and the Owner. Demonstrate the full capabilities of the complete system and obtain the signatures of those persons attending the demonstration. Furnish all equipment and personnel required for the demonstration.

3.7 CLEANUP AND PROTECTION

A. Site Clean Up and Other Protection: The Contractor shall be responsible for all clean up related to its work, including the removal of packing materials etc. and the protection of existing surfaces or equipment. Repairs to damage caused by the Contractor to any item or surface are the sole responsibility of the Contractor.

B. Protection of Installed Equipment: The equipment described in this section is considered to be finished equipment and is to be protected during and after installation from excessive dirt and damage caused by other work.

C. Equipment Cleaning: All equipment and the areas around the equipment shall be cleaned prior to final inspection and acceptance.

3.8 TESTING

A. Operate all equipment for approval of the Architect and/or his representative. Demonstrate proper trim of "sets", leveling of "sets", and balance of "sets" and freedom of movement without fouling. Make all adjustments and modifications necessary and required for approval.

3.9 INSTRUCTION

A. Provide at least six (6) hours of instruction of Owner's personnel in the care and safe operation of the complete system. Obtain the signatures of each person instructed, and their concurrence that they are comfortable with the instruction received.

3.10 WARRANTY & INSPECTIONS

A. Warranty: The Theater Equipment Contractor shall provide a three (3) year written guarantee against defects in materials and workmanship. Within this period, the Theater Equipment Contractor shall provide any required maintenance or replacement within 30 days of written notification by the Owner, except for safety related items that shall be corrected within 48 hours of notification. Subsequent to the expiration of the guarantee period, the Theater Equipment Contractor agrees to furnish repair and maintenance service, at the Owner's expense, within 30 days of request for such service.

B. One Year Inspection: At one year after the date of final acceptance, and as part of this contract, the Theater Equipment Contractor shall provide a comprehensive inspection of all installed systems and components. Make all adjustments as may be required by normal wear and tear. This inspection shall be scheduled directly with the Owner and shall be done at the Owner's convenience.

C. Continuing Inspections: The Theater Equipment Contractor shall offer the Owner estimated costs of a safety inspection and training program to be performed yearly. This program may include systems other than the stage rigging, such as production lighting and audio systems, as well as general backstage safety, at the discretion of the Owner and Contractor.

3.11 OPERATIONS AND MAINTENANCE MANUALS

A. Upon completion of the work the Theatre Equipment Contractor shall submit four detailed printed copies of the operations and maintenance Manuals, 2 for the owner, 1 for the architect/engineer of record and one for the consultants. The contractor shall also submit CD ROMs with the Operations and Maintenance Manuals in PDF form with a hyper link table of contents, also any CAD drawings including as built shop drawings, equipment descriptions, the initial configuration files for the rigging controller and any required certificates or warranties, and parts lists or other electronically produced submittal items. Submit in quantities as required by the Architect. Before distribution of the manuals submit one copy to consultant for approval.

B. Manual shall, at the minimum, include the follow:
1. Contractor's service contact information
2. Set of reduced sized **"as-build"** drawings based on the approved shop drawings
3. Copy of the submittal package minus the color samples
4. System warranty
5. Copy of each drapery label
6. Complete operating instructions
7. Safety guide
8. Maintenance procedures, including schedules
9. Inspection criteria in sufficient detail so that users can realistically carry out system inspections
10. Sample inspection report form specific for each set type installed
11. Rail Log template.
12. CD ROM of all data with files in PDF format.

C. Each manuals presented to the owner shall each include one set of future test swatches listed in the Drapery section

END OF SECTION 11061

SECTION 11 61 44
DRAMA LAB, CCTV STUDIO AND DANCE STUDIO RIGGING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SCOPE

A. Intent: This specification covers the fabrication, furnishing, delivery, provision, and installation of stage rigging, drapery track systems, stage draperies, and related equipment. The form of the contract, general conditions, and the project drawings are considered to be part of these specifications.

B. Definitions: For this project the following entities are referenced:

1. Owner: St. Lucie County School Board
2. Architect: Schenkel Shultz Architects
3. Theatre Consultant: TSG Design Solutions, Inc.

C. This section requires the fabrication, furnishing, delivery, installation and testing of the rigging and draperies as indicated on the drawings and specified herein.

D. The contractor shall provide all items, materials, equipment, labor, tools, scaffolds, and incidentals necessary to perform the scope of work.

E. It is the intention of these specifications that the contractor provides a professional quality, complete and proper operating system in every respect and detail.

F. The installation contractor shall examine the plans in detail to familiarize him with the scope of the work.

G. The contractor shall assume full responsibility for a complete operating installation, in the required location, in accordance with the contract documents.

H. Coordinate fully with the Division 16, Stage Lighting, Structural Steel, Mechanical and all other related contractors. This Contractor shall be responsible for the proper coordination of all details of the installation

I. All work described shall be contracted to and performed by a single qualified firm as described in Section 1.6 Contractor's Qualifications.

J. All details of the installation shall be left in a finished condition, complete and ready for satisfactory operation.

K. Any discrepancies and/or omissions in the drawings and/or specifications shall in no way be construed as authority to deviate from the intent of the contract, which is to provide a complete, first quality installation of a stage rigging system.

L. Anything shown in the drawings or described in this specification shall be considered as part of both.

M. The Contractor shall be responsible for verifying all existing conditions, measurements and other data as may be required for the proper execution of the work of this contract.

N. Errors and Omissions: Any errors, omissions, or ambiguities found in these documents do not relieve the Theater Equipment Contractor of the responsibility of providing all items necessary for complete, safe, fully functional systems. Any errors, omissions, or ambiguities shall be brought to the attention of the Architect/Engineer of Record, Construction Manager, Owner, and/or Theater Consultant for clarification.

O. It is this Contractor's responsibility to ensure that the system and all of the system components, fixtures, equipment, devices, wire, terminations, field assemblies (including custom assemblies), etc. pass all required inspections by the local authority having jurisdiction.

P. Work Included: The work of this section shall include, but not be limited to the following:

1.3 WORK INCLUDED

A. Without restricting volume or generality of above "scope", work to be performed under this section shall include, but not be limited to the following:

1. All necessary miscellaneous steel required to support the rigging equipment overhead.
2. Provide owner training as described herein.
3. Provide owner's manuals and as built drawings as described herein.

B. Drama Lab Room 03-113

1. Complete installation of a 5 'x 5' pipe grid.
2. Complete installation of a wall mounted heavy duty duty walk along bendable traveler track & masking draperies at rear of portable stage.

C. Dance Studio Room# 03-110

1. Complete installation of wall mounted medium duty walk along traveler track(s) & masking draperies to cover studio mirrored wall(s).

D. Vocal Room# 03-115

1. Complete installation of wall mounted medium duty walk along traveler track(s) & masking draperies to cover studio mirrored wall(s).

E. CCTV Studio Room# 01-213

1. Complete installation of a 5 'x 5' pipe grid.
2. Complete installation of a wall mounted medium duty walk along bendable traveler track & masking draperies.

F. It is this Contractor's responsibility to ensure that the system and all the system components, fixtures, equipment, devices, wire, terminations, field assemblies (including custom assemblies), etc. pass all required inspections by the local authority having jurisdiction.

1.4 RELATED WORK NOT INCLUDED

A. The following related items of work, if required, are in other sections and shall not be included under this contract:
   1. Structural Steel and Miscellaneous Metals, Head Block Beams, and Loading Bridges and Railings.
   2. Galleries, Ladders, and Catwalks.
   3. Stage lighting and electrical connections, conduit, junction boxes and wiring to power sources, control locations to the index lights and wiring to all other electrically powered devices listed in these specifications.

1.5 GENERAL REQUIREMENTS

A. Field Conditions: This project is the provision and installation of new stage rigging systems. All bidders are strongly encouraged to survey the areas where the work is to be performed prior to bidding. All bidders shall fully inform themselves of the conditions under which the work is to be performed. No additional compensation or time extension will be given for conditions of which the bidder could have been fully aware prior to bid.

B. Safety: The systems shall conform to all applicable code requirements and shall be provided and installed in conformance to industry standards of operation and practices. All materials, arrangements, and procedures shall comply with applicable code requirements, allowing the end user to arrange and operate a safe assembly and working environment for the audience and user's personnel.

C. Insurance: In the absence of more stringent requirements, the Theater Equipment Contractor shall maintain sufficient injury and property liability insurance coverage throughout the project's scheduled timetable, including workmen's compensation coverage for the Theater Equipment Contractor's employees.

1.6 CONTRACTOR QUALIFICATIONS:

A. Only qualified contractors shall be used.

B. The work of this section will be contracted to a single firm, referred to as the contractor.

C. This Contractor shall assume complete responsibility for the design, fabrication, transportation, and installation of the work in this Section, and shall hold the Owner, Architect, Theater Consultant, and all their Employees and Consultants harmless for any costs for errors or omissions associated with the work of this Section and any action arising there from.

D. The contractor shall be a rigging system contractor who regularly engages in the furnishing, installation and servicing of systems of similar nature, size, scope and complexity to that contemplated by this specification. The contractor shall have done so for a period of not less than five years preceding the bid date.

E. The Stage Equipment Contractor shall be a member in good standing of the Entertainment Services and Technology Association (ESTA) and maintain qualifying membership for the duration of the project

F. The contractor shall have maintained for the five years preceding the bid date, a suitably staffed and equipped service organization which has continuously offered maintenance and repair services for systems of the nature, size, scope and complexity to that contemplated by this specification.

G. The contractor shall maintain for the duration of this contract all required business and professional licenses and insurance.

H. The contractor shall demonstrate to the satisfaction of the owner, through submittals presented in accordance with the project timetable, that the contractor meets all the above qualifications. The minimum contractor qualification submittal shall include the following:

1. Statement of company history. Include a breakdown by percentage of gross sales of all business activities the contractor is involved in for each of the last 5 years (e.g., system installation = 30%, expendable sales = 40%, service = 20%, design and other professional services = 10%, etc.).
2. Previous experience: Provide a list of four installations of the type and size contemplated by these specifications, currently in use as originally installed, in which a theatre / system consultant was involved, completed in the last 5 years and the following information regarding each installation:
    a. Name and address of each installation.
    b. Facility owner and telephone number.
    c. Name, address, and phone number of a person regularly employed by the owner, who is familiar with the operation of the systems and who has no connection or business connections with the contractor except as the contractor shall fully disclose
    d. Name, address, and phone number of the theatre or system consultant, along with the names of all the consultant's personnel directly involved.
    e. System shop drawings. These will be returned if the contractor provides a call tag or return postage.
    f. Owner's manual drawings - These will be returned if the contractor provides a call tag or return postage.
    g. System as-built drawings - These will be returned if the contractor provides a call tag or return postage.
    h. List of contractor's personnel involved with each person's responsibility on the project.
    i. Name, address and phone number of the general contractor, along with the names of all key GC personnel directly involved.
    j. Name address and phone number of the electrical contractor, along with the names of all key EC personnel directly involved.
3. Statement of current company capabilities and ownership.
4. Key Personnel. For each of the key personnel listed below; Include individual's name, title, and number of continuous years of service to contractor. Include a resume detailing industry experience, and role within organization (include only full-time/regular staff employees; not independent contractor, freelance, or temporary positions). List all industry certifications held, training courses attended, and continuing education credits, including dates of attendance. List recently completed projects, scope of project, and completion dates.
    a. Project Manager
    b. Senior Technician
    c. Service Manager

5. Other Department Staff. Include size of staff and experience of each staff member.
6. Replacement and Spare Parts Inventory – Provide detailed list of primary replacement parts, components, and spares typically held in inventory.
7. Test Equipment and Physical Plant – Include an inventory of all test facility equipment owned and used regularly by the Service Department. Provide description of physical plant and space utilization.
8. Copies of all business and professional licenses and insurance certificates.

I. For the purposes of this contract, Dealers, Jobbers, and Sales Representatives SHALL NOT be considered as eligible participants.

J. Without prejudice to others, the following contractors are considered qualified and do not need to submit contractor's qualifications:

InterAmerica Stage, Inc.
4300 St. John's Parkway
Sanford, FL 32771
(407) 302-0881
Contact: Mark Black

Mainstage Theatrical Supply, Inc.
8761 A Ely Dr.
Pensacola, FL 32514
Tel: 850-434-2080
Fax: 850-434-6046

Miami Stagecraft/ S.E.A.L. a Solotek company
12250 NE 13th Ct.
North Miami, FL 33161
(305) 891-1000
Contact: Steve Welsh

1.7 SUBMISSIONS

A. A. Drawings:

1. Submit plans, elevations, sections, and equipment schedules to the Architect of all systems, components, installation methods, and schedules showing all information necessary to fully explain the design features, appearance, function, fabrication, load ratings, installation and use of system components in all phases of operation.
2. All drawings shall be prepared under the direct supervision of, and sealed by, a Professional Engineer licensed in the state of Florida and familiar with the design and installation of stage equipment.
3. The drawings shall be no less detailed than as provided in the contract documents.
4. System plans, elevations, and sections shall be submitted on minimum D-size (24x36) sheets and shall be drawn in no less than 1/4" =1'-0" scale.
5. Submit in quantities as required by the Architect.

B. Catalog Cuts: In lieu of detailed equipment drawings, the Theater Equipment Contractor may submit catalog cuts for standard, unmodified equipment.

1. All catalog cuts shall contain full information on dimensions, construction, applications, load ratings, etc., to permit proper evaluation.

2. Catalog cuts shall be properly identified as to their intended use. Any options or variations shall be clearly noted.
3. Detailed drawings of any modified standard equipment shall be submitted for approval as described in Section 1.7.A.
4. Catalog cut sheets shall be prepared and bound in a professional manner, with each sheet properly indexed to a “Table of Contents”. Loose or stapled sheet sets are not permitted.
5. All copies of catalog cut sheets must be clear and legible.
6. Submit in quantities as required by the Architect.

C. Samples: Provide samples of all fabrics and color choices for selection and approval. Hardware or component samples shall be provided upon written request. Submit in quantities as required by the Architect

D. Approvals: All submissions must be approved per the requirements of the project’s general conditions prior to the beginning any fabrication, installation, or erection. Such approval does not relieve the Theater Equipment Contractor of the responsibility of providing equipment in accordance with the specifications or of providing fully operational and safe systems.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All materials and equipment shall be furnished in the quantities needed to complete the scope of the work.

B. All materials and equipment used in this project shall be new, unused and of the latest models and design. Refurbished materials and equipment are not permitted.

C. Any item of equipment or hardware that may not be specifically shown on the drawings or specified herein but required for proper system operation or installation shall be furnished and installed and be of the highest quality available.

D. Prior to fabrication of materials, the Contractor shall visit the site and measure for the exact fit of all materials and assure themselves of the appropriateness of the materials.

E. Shop and field welding techniques used shall be those described by the appropriate sections of "Specifications for Design, Fabrication and Erection of Structural Steel for Buildings", of the American Institute of Steel Construction, 6th Edition.

F. Painting: All steel rigging components shall be cleaned of rust, scale and any foreign matter. Finish paint color shall be Flat Black.

G. Machining and Finishing: Operating parts of all rigging equipment shall be suitably machine finished. Tolerances and fit and finish, where not specified, shall conform to good trade practices.

H. UL Labels: All equipment, where applicable standards have been established, shall be listed by Underwriters’ Laboratories, Inc., and shall bear UL label when delivered to the job.

I. If so required by the local authority having jurisdiction, anything not arriving at the job bearing a UL label shall be field inspected and label by a nationally recognized testing laboratory recognized and approved by the local authority having jurisdiction.

J. Recommended Working Load: This specification calls for minimum recommended working loads for many hardware items. The manufacturer's recommended working load is the maximum load which the manufacturer recommends is applied to properly installed, maintained, and operated new equipment. Manufacturer's recommended working loads shall be determined by calculations by a Licensed Professional Engineer and destructive testing by an independent testing laboratory. These calculations and reports shall be available for review.

K. All moving parts shall have specified tolerances. Sheaves shall run plumb and true and shall not scrape housings.

L. Where dimensions and loading capacities have been omitted from this specification, they are to be determined by the bidder in accordance with accepted industry standards and the guidelines in this section. In no way shall the Stage Equipment Contractor be relieved of the primary responsibility to provide a safe, fully functional system.

M. All equipment shall be built and installed to facilitate future maintenance and replacement.

N. The mechanical fabrication and workmanship shall incorporate best practices for good fit and finish. There shall not be any burrs or sharp edges to cause a hazard nor any sharp corners accessible to personnel.

O. All finishes which are disturbed during shipping and installation shall be touched up to match the original.

2.2 APPROVED MANUFACTURERS

A. Due to their interrelated design, all the stage equipment in this specification shall be supplied by one qualified stage rigging manufacturer who shall be responsible for coordinating the required design and installation details

B. One approved stage drapery manufacturer shall supply all Draperies in this specification.

C. In general, the component units have been described in detail in order to obtain the required performance. The specifications are minimum requirements, and in no case will items of lesser design be acceptable. Only components that in the opinion of the Architect upgrade the unit in all ways will be considered. Manufacturers' standard off-the-shelf components will not be considered unless they meet the minimum specifications.

D. The use of "brand names" has been held to a minimum in these specifications and when used are to establish a quality and performance standard. Items by other manufacturers not included in the Approved Manufacturers list may be used after written approval has been obtained from the Architect.

E. Substitutes shall be considered only when they are submitted fourteen days prior to bid date, and are accompanied by sufficient drawings, catalog data, specifications, and technical information for evaluation.

F. The following are approved automated theatrical rigging manufacturers:

J.R. Clancy, Inc.
7041 Interstate Island Road
Syracuse, New York 13209
(315) 451-3440

InterAmerica Stage, Inc.
4300 St. John's Parkway
Sanford, FL 32771
(407) 302-0881
Contact: Mark Black

Mainstage Theatrical Supply, Inc.
8761 A Ely Dr.
Pensacola, FL 32514
Tel: 850-434-2080
Fax: 850-434-6046

Texas Scenic
5423 Jackwood Drive
San Antonio, TX 78238
(800) 292-7490
Contact: Michael Gonzales

G. The following are approved stage rigging equipment manufacturers:

J.R. Clancy, Inc.
7041 Interstate Island Road
Syracuse, New York 13209
(315) 451-3440

Peter Clark Inc.
5204 Highgreen Court
Colfax, North Carolina 27235
(336) 370-4896

H&H Specialties
2203 Edwards Avenue
South El Monte, CA 91733
(800) 221-9995

Mainstage Theatrical Supply, Inc.
8761 A Ely Drive
Pensacola, FL 32514
(850) 434-2080
Contact: Ken Leichhardt

InterAmerica Stage, Inc.
4300 St. John's Parkway
Sanford, FL 32771
(407) 302-0881
Contact: Mark Black

H. The following are approved stage drapery fabricators:

Rose Brand
75 Ninth Avenue
New York, New York 10011
(212) 242 7554

Stage Decoration and Supplies
3519 Associate Drive
Greensboro, North Carolina 27405
(336) 621 5454

I Weiss and Sons, Inc.
2-07 Borden Avenue
Long Island City, New York 11101
(718) 706 8139

Gerriets International
29 Hutchinson Road
Allentown, New Jersey 08501
(800) 369 3695

I. The following are approved sources for stage drapery material:

K-M Fabrics
2 Waco Street
Greenville, South Carolina
(864) 295 2550

Dazian
124 Enterprise Ave. So.
Secaucus, New Jersey 07094
(201) 549 1000

Gerriets International
29 Hutchinson Road
Allentown, New Jersey 08501
(800) 369 3695

J.B. Matrin Ltee
445 St-Jacques
St-Jean-sur-Richelieu, Quebec J3B 2M1
(450) 346 6853

J. The following are approved curtain track manufacturers:

Automatic Devices Company
2121 South 12th
Allentown, Pennsylvania
(800) 360 2321

H&H Specialties
2203 Edwards Avenue

South El Monte, CA 91733
(800) 221-9995

2.3 CONSTRUCTION STANDARDS:

A. Construction of all rigging component parts shall meet the following minimum standards:

B. Materials shall conform to the following ASTM and ANSI standard specifications:
1. A-36 - Specification for structural steel
2. A-47 - Specification for malleable iron casting
3. A-48 - Specification for gray iron casting
4. A-120 & A-53 - Specification for black and hot-dipped zinc-coated (galvanized) steel pipe for ordinary use
5. B18.2.1&2 - Specification for square and hex bolts and nuts

C. In order to establish minimum standards of safety, the following factors shall be used:
1. Overall minimum safety factor for all rigging and related components: 8.
2. Cables and fittings - 8:1 Safety Factor
3. Cable bending ratio - Sheave tread diameter minimum 30 times cable diameter
4. Tread Pressures:
   a. 500 lbs. for cast iron
   b. 900 lbs. for Nylatron
   c. 1000 lbs. for steel
5. Maximum fleet angle - 1-1/2 degrees
6. Steel - 1/5 of yield
7. Bearings - Two times required load at full speed for 2000 hours
8. Bolts - Minimum SAE J429 Grade 5 (ISO R898 Class 8.8), zinc plated
9. Motors - 1.0 Service Factor
10. Gearboxes - 1.25 Mechanical Strength Service Factor

D. Sheaves shall be of the following materials, as specified:
1. ASTM A-48 Class 30 grey iron castings
2. Cast Nylatron GSM
3. Injection molded Nylatron GS.
4. Steel
5. Groove depths shall be sufficient to encompass fully the cables and ropes. Grooves shall have sloped sides (8 degree minimum) and conform to rope and cable manufacturers' standards for groove shape and tolerance.
6. Sheaves shall be supported by bearings and a machined steel shaft, which shall be keyed to one side plate to prevent rotation. Proper adjustment of the bearing shall be accomplished by means of a fine thread, self-locking nut on the opposite end of the shaft. Each sheave shall run plumb and true without rubbing its side plates when rotated.
7. Custom side plates are required. Field measurements must be taken before manufacturing loft blocks and head block.

2.4 NEW STAGE RIGGING SYSTEM COMPONENTS

A. General: The following listing is provided as a general guide to the major components required for this project. It is not intended to be a complete listing of all equipment and components required to provide fully functional systems. Materials, fabrication, and installation shall be as shown in the drawings and as specified herein. The Theater Equipment Contractor

is solely responsible for providing all items necessary for complete, safe, fully functional systems that meet the intent of these specifications.

B. Bills of Materials

1. Provide and install a dead hung pipe grid in Drama Lab Room # 03-113. Pipe grid shall be made up of, but limited to:
   a. 1 lot 1 ½" ID schedule 40 pipe battens in lengths and quantities as shown on the drawings.
   b. 1 lot of cross grid clamps.
   c. 1 lot of sleeved plates to attach pipe grid to walls to prevent lateral movement.
   d. 1 lot of hanging hardware to rigidly attach pipe grid to overhead steel structure.

2. Provide and install a dead hung pipe grid in CCTV Studio Room # 01-213. Pipe grid shall be made up of, but limited to:
   a. 1 lot 1 ½" ID schedule 40 pipe battens in lengths and quantities as shown on the drawings.
   b. 1 lot of cross grid clamps.
   c. 1 lot of sleeved plates to attach pipe grid to walls to prevent lateral movement.
   d. 1 lot of hanging hardware to rigidly attach pipe grid to overhead steel structure.

3. Provide and install wall mounted drapery track(s) and draperies rigged for walk along operation in the and Dance Studio Rm# 03-110 and the Vocal Rm# 03-115. Drapery track(s) and draperies shall be made up of, but not limited to:

4. Provide and install grid mounted bendable drapery track(s) and draperies rigged for walk along operation in the Drama Lab Rm#03-113 and CCTV Studio Rm# 01-213. drapery track(s) and draperies shall be made up of, but not limited to:

5. Provide and install system signage as specified herein.

2.5 DEAD HUNG RIGGING EQUIPMENT SPECIFICATIONS

A. Trim Chains:

1. Trim chains shall be 36" long, made of 1/4" plated, grade 30 Proof Coil chain. Connection between the end link and the lifting cable shall be made with a thimble and copper Nicopress sleeve. Chains shall be wrapped one and one half turns around the batten and attached back to the thimble at the end of the lift line with a ¼" forged shackle. Adjustment is made by connecting the shackle into a link along the return side of the chain.
2. Trim chains shall have a recommended working load of at least 750 lbs.

B. Lift Cables:

1. All lift cables shall be 7 x 19 construction, galvanized aircraft cable, sized as required, and with breaking strengths as follows:
   a. 1/8" diameter 2,000 pounds
   b. 3/16" diameter 4,200 pounds
   c. 1/4" diameter 7,000 pounds
   d. 5/16" diameter 9,800 pounds
   e. 3/8" diameter 14,400 pounds

2. Damaged or deformed cable shall not be used. All wire rope rigging shall be installed so as to prevent abrasion of the wire rope against any part of the building construction or other equipment.

C. Cable Fittings:

1. Swaged sleeve fittings shall be copper Nicopress™. Swaged fittings shall be installed per the fitting manufacturer's instructions, using the appropriate tools, and checked with the appropriate Nicopress™ "Go - No go" gauge. Clamp type "cable clips" shall not be permitted.
2. Eyes shall be formed over galvanized wire rope thimbles of correct size.
3. Exposed cable ends shall be sealed in black heat-shrink tubing.

D. Turnbuckles: Turnbuckles shall be drop forged and galvanized, and conform to ASTM F-1145 Type 1, Grade 1. Turnbuckles shall be moused after adjustment to prevent loosening.

E. Beam Clamp:

1. Beam clamps shall have two 7-gauge, painted steel plates punched to grasp a beam flange. Each plate shall have multiple holes to allow adjustment for a range of flange sizes.
2. Clamps shall be complete with two 3/8" x 1" hex bolts with lock nuts, and a 1/4" round pin anchor shackle.
3. Beam clamps shall have a recommended working load of at least 350 lbs.

F. Pipe Battens:

1. All battens shall be 1-1/2" nominal inner diameter, Schedule 40 black iron pipe in lengths as shown on the drawings.
2. All joints shall be spliced with 18" long sleeves with 9" extending into each pipe and held by two 3/8" dia. x 2 1/4" long hex bolts and low profile jam lock nuts on each side of the joint. Welded connections are not permitted. Any gap between pipe sections shall not exceed ¼".
3. Each end shall be covered with a bright yellow, closed end, soft vinyl safety cap at least 4 inches in length.
4. Pipe battens shall carry set numbers and centerline indicator marks as specified.

2.6 DEAD HUNG PIPE GRID

A. Pipe Grid:

1. Pipe grids shall be constructed from lengths of 1.5 inches (38.1 mm) nominal I.D. schedule 40 iron pipe. All joints shall be sleeve spliced with 18 inches (457.2 mm) long sleeves with 9 inches (228.6 mm) into each pipe and held by two 3/8 inch (9.5 mm) hex bolts and lock nuts on each side of the joint. Grids shall be installed as indicated on the drawings with pipes intersecting on five foot by five-foot centers.
2. Intersecting pipes shall be joined with a Cross Grid Clamp or by an approved equal. The cross grid clamp shall have a recommended working load of at least 1,500 lbs. (680 kg). U-bolts are not acceptable.
3. Each pipe shall terminate just off the wall. Internally sleeved wall plates shall securely brace the grid against the wall once it is in place. Supply sufficient braces to prevent lateral movement of the pipe grid.
4. The grid shall be rigidly hung from the overhead steel structures on centers not exceeding 8 feet in either direction using 1/4 inch (6.4 mm), 7x19 galvanized utility cable ending in 6 inches

x 3/8 inch (152.4 mm x 9.5 mm) forged turnbuckles attached to pipe clamps or connector strip hanging brackets. At each hanging point the cable shall attach to the overhead structure with an appropriate fitting. Cables shall be formed over thimbles of correct size and fastened with two forged cable clips or Nicopress sleeves. Turnbuckles shall be safe tied with tie wire after final trim.

2.7 MASKING DRAPERY TRACKS

A. Medium Duty Curtain Track: (Drama Lab, CCTV Studio and Dance Studio Masking Drape Walk Along Tracks)

1. 170 Medium Duty Curtain Track.
   a. Track shall be of 14 ga (1.980 mm) galvanized construction, entirely enclosed except for the slot in the bottom. Each section of track less than 20 ft (6,096 mm) shall be in one continuous piece. Splice clamps shall be permitted for section lengths over 20 ft (6,096 mm).
   b. Carriers shall be constructed of plated steel, supported from two heavy-duty polyethylene wheels attached to the carrier body by a nickel-plated steel rivet. Each carrier shall be equipped with a free-moving plated steel swivel to accommodate a curtain S-hook. Rubber washers shall be provided between each backpack and carrier to reduce noise. Each drapery carrier shall be spaced on 12" centers.
   c. End stops at each track end, and one shall be furnished.
   d. Track shall be rigged for walk along operation. Wall Mounting Bracket for Model 170 track in single track applications shall be provided for suspension at 5 ft foot maximum intervals, minimum of 4 brackets per track.

2.8 MASKING DRAPERIES AND RELATED WORK

A. Fire Prevention

1. All fabrics and materials used in this installation shall be inherently flameproof to render them flame retardant in accordance with all applicable regulations and life safety codes.
2. An original, signed and notarized certificate of flame-retardant treatment shall be executed and presented to the Owner for each fabric prior to installation.
3. A permanent label shall be affixed to each curtain stating:
   a. The name, address and telephone number of the manufacturer
   b. The name, address, and telephone number of the contractor
   c. The item name (leg, border, main drape, etc.)
   d. The face finished dimensions of the piece
   e. The flame proofing certification minimums complied with
   f. Cleaning and maintenance instructions needed to retain flame retardant characteristics
   g. The timetable for re-treatment when appropriate
   h. The fire-retardant re-treatment process to be used
4. The flame-retardant treatment shall not contribute to the aging or deterioration of the material in any way.
5. The flame-retardant treatment shall not cause staining or color transfer from one material to another or at any time form visible crystals or striations or in any other way affect the integrity of the material.
6. Provide a three 24” x 24” swatch for each different type of fabric from the same lot as the pieces on site for future testing. One set of swatches shall be pinned to the rear of the drapes on site at the time of inspection. The other two shall be included in the

Owner's Manuals that are turned over to the owner. Each test swatch shall be labeled as called for above.

B. General Construction Standards

1. Fabrics shall be first quality throughout. No "seconds" or off standard materials shall be accepted.
2. All materials of the same type and color shall be from the same dye lot and from the same basic product manufacturer.
3. All fabric runs shall be full height with no horizontal seams, except as noted.
4. All pile fabrics or materials with a 'run' or 'lay' shall have a pile running down.
5. All drapery as removed from bolts shall be tabled across an inspection window for detecting flaws and imperfections
6. All flaws shall be cut out and not incorporated in the finished work.
7. Thread colors shall match face fabric colors.
8. All thread ends and stitch terminations shall be securely finished so as not to ravel in rough handling.
9. All drapery edges shall hang plumb within 2" of vertical.

C. Fullness:

1. Fullness shall be in addition to all allowances for hems and turn backs and other basic construction details.

D. Pleats:

1. Pleats shall be box type on 12" centers.
2. Drapes called for to be pleated shall be pleated such that vertical seams are included in the pleats and fall in the upstage curvature of fabric folds.

E. Top Finish:

1. All draperies shall be reinforced with 3-1/2" heavy-duty jute webbing
2. All draperies shall be double stitched to the top 2 ¾" apart with 1 inch of face fabric turned under.
3. The centerline of each piece shall be clearly marked on the jute webbing.

F. Grommets, Tie Lines, and S-Hooks:

1. All grommets shall be #3 brass and machine set.
2. All pleated curtains shall have brass grommets inserted in pleat centers.
3. Each upper corner of each traveler section shall have double grommets precisely arranged to fit double chains of master carriers regardless of whether drapery section is used right or left stage.
4. All un-pleated curtains shall have brass grommets inserted 9 inches on centers.
5. All curtains mounted to prime pipes shall be supplied with 36" #4 braided cotton tie lines, black in color, installed in the drape.
6. A single opposing color tie line shall be supplied at the center point of each drape.
7. All curtains mounted to traveler tracks shall be supplied with the appropriate S-hooks and all necessary accessories.

G. Bottom Hems:

1. Prior to sewing the bottom hem, the otherwise completed drape shall be hung full height to their finished width and allowed to hang untouched for two weeks.
2. All materials sewn with fullness shall have 6" bottom hems with separate interior canvas chain pocket
3. All chain pockets shall be stitched so that the chain will ride 2" above the finished bottom edge of the curtain.
4. All materials with chain pockets shall be supplied with #8 plated jack chain or equivalent.
5. Lead tape or other toxic substances shall not be incorporated into any drapery in this section.
6. All materials sewn without fullness shall have a 6” bottom hem with a separate interior canvas pipe pocket unless otherwise noted in this spec or on the curtain & track schedule.
7. All pipe pockets shall be stitched so that the pipe will ride 2" above the finished bottom edge of the curtain.
8. All materials with pipe pockets shall be supplied with 3/4” ID schedule 40 pipe coupled in 10' sections.

H. Side Hems:

1. Leading edges of all travelers shall have ½ face width turn backs.
2. Scrim and Cyclorama shall have side hems of 4".
3. All other side hems shall be 2".

I. Dimensions: All dimensions given in this specification are "face finish" and do not include allowance for fullness and hems.

J. Acceptable fabrics shall be:

1. IFR Velours:

a.	KM Fabrics	Prestige and Encore
b.	Dazian	Allure
c.	Gerriets	Clivia 54 and Porza 54
d.	J.B. Martin	Ovature
e.	Rose Brand	Chrisma

K. Leno Filled Scrim

a.	Dazian	Filled Scrim (Leno filled scrim)

L. Furnish, deliver and install in quantities and size required to complete this job as shown on the drawings, related drapery schedules, and as specified herein:

M. Field verify dimensions prior to fabrication.

2.9 SYSTEM SIGNAGE

A. System Sign: Provide and install one (1) system informational signs. The signs shall be installed adjacent to the wall mounted performance lighting controller. The sign shall describe the following:

1. Maximum pipe grid capacities
2. Maximum single point load capabilities.
3. Name, address, and phone number of installation contractor
4. Name, address, and phone number of equipment manufacturer

5. Date of installation (month and year)
6. Statement - “Pipe Grid rigging system must be inspected yearly by qualified personnel”.

B. Sign Materials and Lettering size:

1. Signs shall be of minimum 3/16” thick red non-glare plastic.
2. Lettering shall be white in color in a non-serif font, such as Helvetica or Arial, in ALL CAPS, and in font sizes as specified herein.
3. Signs shall be mechanically affixed to the walls within sight of the hoist control. Glued applications are not permitted.
4. Signs shall be professionally produced. No hand or “stick on” lettering is permitted.

PART 3 - EXECUTION

3.1 GENERAL

A. Fabricate and install items in conformity with applicable trade practices and manufacturer's recommendations, unless specifically excepted by Specifications or Drawings

B. Carry out shop and field welding in full conformity with applicable AISC, ASME, AWS and ASA standards.

C. Comply with local codes. In absence of local codes, comply with AISC, NEC, and ASA standards as applicable.

D. Furnish, turn over to Owner's designated representative and obtain receipt for all spare parts and equipment required as part of this project.

E. Workmanship and finish must be first class in every particular and strictly in accordance with the best practices. The work shall be made in accordance with the reviewed shop drawings. Work made in sections shall be carefully fitted together. Units shall be properly laid out and spaced between terminals.

F. Only experienced riggers shall be used on the work and a supervisor carrying an ETCP Certification in Theatrical Rigging shall be present during the entire installation.

G. An experienced, qualified representative of the rigging hardware and drapery manufacturer shall be present at all times during the installation

H. The entire installation shall be made with the assistance of the factory-authorized representative of the equipment manufacturer. The equipment manufacturer's recommendations and instructions are to be fully implemented.

I. Storage: The Contractor shall be responsible for storage of stage equipment, tools, and its equipment during the period of the installation.

J. Damage Protection: The Stage Rigging Contactor shall take all precautions necessary to prevent damage to the stage floor, walls, and all other existing finishes during installation

3.2 SHOP DRAWINGS AND SUBMITTAL

A. Within thirty (30) days of bid award and prior to beginning work, prepare and submit shop drawings to the Architect for approval. These drawings shall be detailed and complete on all phases of the installation. The drawings shall include details of all rigging hardware components. Shop drawings shall be approved by the Architect prior to fabrication, installation or erection have begun. Minimum plates required shall be:
   1. Title sheet
   2. Scale plan and section drawings
   3. Scale elevation drawings of each line set type included (fire curtain, gp sets, electric sets, etc.)
   4. Assembly drawings of all major components including dimensions, weights and bill of materials
   5. Electrical riser, interconnect and block diagrams
   6. Scale drawings of all electrical and control system components, complete assemblies and control stations
   7. Scale location drawings of all electrical components required (both those provided by the rigging contractor and those provided by the electrical contractor). This drawing shall be used by the electrical contractor to coordinate the electrical “rough in” and correct placement is the responsibility of the rigging contractor

B. Approval of shop drawings does not relieve the Contractor of the responsibility of providing equipment in accordance with these specifications. Any deviations from the specifications shall be "starred" and noted in 1/4" high letters. Only deviations which upgrade the quality of the equipment shall be considered.

C. Individual components shall be detailed as required to illustrate materials, thicknesses, sizes, capacities and methods of assembly or attachment to adjoining components.

D. Shop drawings shall show all system loads, safety factors, system capacities and imposed building loads.

E. Specific notes shall be included pertaining to the adequacy of the related structural steel, miscellaneous metals and electrical accommodations as they appear on the contract drawings

F. Shop drawing shall be fully coordinated with all other disciplines and site data and dimensions

G. Included with the shop drawings shall be a submittal package including:
   1. Complete color selection samples of curtain materials for Architect's selection.
   2. Catalog information and cut sheet of all standard equipment
   3. Catalog information and cut sheets of all electrical components
   4. Owner’s manuals for everything electrical in nature and any complex mechanical machinery (e.g., winches)
   5. Complete drapery and curtain track information and cut sheets
   6. The required flame-retardant certifications from the Drapery section of this specification.

H. Shop drawing and submittals shall be revised and resubmitted as required.

3.3 FABRICATION

A. Machine finish operating parts to standard trade tolerances, fits, and finishes, unless otherwise specified.

B. Paint all fabricated work flat black unless specified on the drawings or herein.

3.4 JOB CONDITIONS

A. Take required measurements at the building. Consult with the various other Contractors whose work adjoins this work. This Contractor shall be responsible for the proper coordination of all details of the installation.

B. Do drilling and fitting and work of similar character required in the fitting and setting of the materials in place and do cutting and fitting required in connection with the fitting of these materials to the adjoining work of other Contractors.

C. Provide connecting members needed for properly supporting and securing the work to the masonry, joints, walls, structural members, or other parts of the building as may be best suited for each case.

3.5 INSTALLATION

A. Position items accurately as indicated on Drawings and true to plumb line and level.

B. Use fittings and clips conforming to cable manufacturer's recommendations as to size, number, and method of installation.

C. Form rope and cable eyes over properly sized thimbles at requisite connection points.

D. Do required cutting, drilling, tapping, and welding necessary to properly install work.

E. Consult and coordinate work with trades doing adjoining work.

F. Install all rigging components to maximize batten travel.

G. Provide completed installation, ready for satisfactory operation, prior to tests and inspection. Advise the Architect in writing that the installation is so completed and ready for acceptance tests and inspection.

H. Adjust hand line lengths for proper tension block take up after initial stretch of line.

I. Curtains are to be installed on their proper tracks and battens and trimmed to the floor in the best manner known to the profession.

J. Installation practices:

1. Installation practices shall be in accordance with Federal OSHA Safety and Health Standards and all local codes. Certified welders shall perform all field welding in full compliance with the latest edition of the Structural Welding Code (ANSI/AWS D1.1) and any other applicable local and state codes and regulations.
2. Equipment shall be installed in a workmanlike manner, per plans and specifications. Equipment shall be aligned, adjusted, and trimmed for the most efficient operation, the greatest safety and for the best visual appearance.
3. Field Welding: All proposed field welding shall be described and submitted in detail in the form of sketches and/or drawings for review by the Architect/Engineer of Record/Engineer of Record.

4. Touch-Ups: Any welds or cuts shall be touched up to match disturbed finishes. All finishes which are disturbed during shipping and installation shall be touched up to match the original.

3.6 INSPECTION

A. The job will be inspected periodically by the Architect and/or his representative while work is in progress, and the Contractor shall accord his full cooperation in the examination of work and materials, which may include dismantling of the equipment for examination of component interior parts. Any equipment found not meeting the specification shall be removed immediately from the job.

B. Arrange for the Consultants inspection of the system. Upon completion of the Consultants punch list, arrange for demonstration of the system by the manufacturer's designated representative at a time acceptable to the Consultant and the Owner. Demonstrate the full capabilities of the complete system and obtain the signatures of those persons attending the demonstration. Furnish all equipment and personnel required for the demonstration.

3.7 CLEANUP AND PROTECTION

A. Site Clean Up and Other Protection: The Contractor shall be responsible for all clean up related to its work, including the removal of packing materials etc. and the protection of existing surfaces or equipment. Repairs to damage caused by the Contractor to any item or surface are the sole responsibility of the Contractor.

B. Protection of Installed Equipment: The equipment described in this section is considered to be finished equipment and is to be protected during and after installation from excessive dirt and damage caused by other work.

C. Equipment Cleaning: All equipment and the areas around the equipment shall be cleaned prior to final inspection and acceptance.

3.8 TESTING

A. Operate all equipment for approval of the Architect and/or his representative. Demonstrate proper trim of "sets", leveling of "sets", and balance of "sets" and freedom of movement without fouling. Make all adjustments and modifications necessary and required for approval.

3.9 INSTRUCTION

A. Provide at least four (4) hours of instruction of Owner's personnel in the care and operation of the complete system. Obtain the signatures of each person instructed, and their concurrence that they are comfortable with the instruction received.

3.10 WARRANTY & INSPECTIONS

A. Warranty: The Theater Equipment Contractor shall provide a three (3) year written guarantee against defects in materials and workmanship. Within this period, the Theater Equipment Contractor shall provide any required maintenance or replacement within 30 days of written

notification by the Owner, except for safety related items that shall be corrected within 48 hours of notification. Subsequent to the expiration of the guarantee period, the Theater Equipment Contractor agrees to furnish repair and maintenance service, at the Owner's expense, within 30 days of request for such service.

B. One Year Inspection: At one year after the date of final acceptance, and as part of this contract, the Theater Equipment Contractor shall provide a comprehensive inspection of all installed systems and components. Make all adjustments as may be required by normal wear and tear. This inspection shall be scheduled directly with the Owner and shall be done at the Owner's convenience.

C. Continuing Inspections: The Theater Equipment Contractor shall offer the Owner estimated costs of a safety inspection and training program to be performed yearly. This program may include systems other than the stage rigging, such as production lighting and audio systems, as well as general backstage safety, at the discretion of the Owner and Contractor.

3.11 OPERATIONS AND MAINTENANCE MANUALS

A. Upon completion of the work the Theatre Equipment Contractor shall submit four detailed printed copies of the operations and maintenance Manuals, 2 for the owner, 1 for the architect/engineer of record and one for the consultants. The contractor shall also submit CD ROMs with the Operations and Maintenance Manuals in PDF form with a hyper link table of contents, also any CAD drawings including as built shop drawings, equipment descriptions, the initial configuration files for the rigging controller and any required certificates or warranties, and parts lists or other electronically produced submittal items. Submit in quantities as required by the Architect. Before distribution of the manuals submit one copy to the consultant for approval.

B. Manual shall, at the minimum, include the follow:
1. Contractor's service contact information
2. Set of reduced sized **"as-build"** drawings based on the approved shop drawings
3. Copy of the submittal package minus the color samples
4. System warranty
5. Copy of each drapery label
6. Complete operating instructions
7. Safety guide
8. Maintenance procedures, including schedules
9. Inspection criteria in sufficient detail so that users can realistically carry out system inspections
10. Sample inspection report form specific for each set type installed
11. Rail Log template.
12. CD ROM of all data with files in PDF format.

C. Each manual presented to the owner shall each include one set of future test swatches listed in the Drapery section

END OF SECTION 11 61 44

SECTION 11 61 45
CCTV EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Front-setting curtains including front curtain and tormentors.
2. Intermediate-setting curtains including valance, intermediate curtains and intermediate legs.
3. Cyclorama-setting curtains including borders, legs, travelers and rear curtain.
4. TV Studio Curtain and Track.

1.3 SUBMITTALS

A. Product Data: For each type of product and the following:

1. Tracks: Capability of each track to support the weight and operation of curtains that it supports

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and attachment details of curtain.
2. Include fabric assembly and hanging details.
3. Include documentation of capacity of each batten, track, attachment, and rigging component to support loads.
4. Points of attachment for curtain and the corresponding static and dynamic loads imposed on structure.

C. Samples: Provide (3) 12-inch x 12-inch samples section of each fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.

D. Product Certificates: For the following, from manufacturer:

1. Fabric: Provide name of flame-retardant chemical used, identification of applicator, treatment method, application date, allowable life span for treatment, and details of any restrictions and limitations.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For curtain, tracks and accessories to include in operation and maintenance manuals.

B. Record Drawings and Data: Submit in accordance with General Provisions. Also, within 30 days of final test and completion of the installation, submit the following to the Owner:

1. Three (3) complete sets of “as built and approved” drawings (rolled, not folded showing systems and elements as installed, including field modifications and adjustments and one digital electronic copy in DWG Format.
2. Three (3) notarized Certificates from the Manufacturer stating Inherent Flame Resistance of each Curtain type installed.
3. Three (3) Certificates of Guarantee

1.5 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications: Firm experienced in producing stage curtains similar to those indicated for this project that have a record of successful in-service performance, and with sufficient production capacity to produce required units without causing a delay in the work.

B. Pre-installation Conference: Construction Manager/General Contractor shall conduct a pre-installation meeting with the Project Manager, TV installation contractor, Video Services, and Architect/Engineer.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install curtain until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Check actual stage curtain openings by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying work.

1.7 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of - curtain systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Provide curtains meeting the following requirements as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Performance Characteristics: Provide stage curtains that are certified to be flame resistant according to requirements of NFPA 701. Permanently attach label to each curtain indicating whether curtain is permanently and inherently flame resistant, or whether it will require retreatment after dry cleaning.

2.2 FRONT-SETTING FABRIC (MULTI-PURPOSE STAGE)

A. Woven Cotton Velour: Napped fabric of 100 percent cotton; 54-inch minimum width; not less than 40 backing ends per inch, 40 pile ends per inch, and 32 picks per inch; 640 pile tufts per square inch; and other characteristics as follows:

1. Heavy Weight: Fabric weighing not less than 25 oz. per linear yard before flameproofing, with pile height of approximately 135 mils.

B. Lining: Yarn-dyed denim cloth of 100 percent cotton, woven in a warp-faced twill; 54-inch minimum width.

C. Colors: Where manufacturer's standard products are indicated, provide colors complying with the following requirements:

1. For woven cotton velour, provide ARCHITECT'S selections from manufacturer's full range of standard colors.
2. For lining, provide black color.

D. Product: Subject to compliance with requirements, provide the following velour fabrics: Memorable, KM Fabrics, Inc., or approved equal.

2.3 INTERMEDIATE AND CYCLORAMA SETTING FABRIC / TV STUDIO CURTAIN

A. Basis of Design Product and Manufacturer; Rose Brand, 128" Poly Cyc, IFR, or approved equal.

1. Color Chroma-Key-Green.
2. Weight: 87 Oz. per linear yard.

2.4 CURTAIN FABRICATION

A. General: Provide not less than 50 percent additional fullness for curtains, unless otherwise indicated. Provide vertical seams unless otherwise indicated. Do not use fabric cuts less than half width. Fabricate velour curtains with the nap down.

1. Vertical Hems: Provide vertical hems not less than 2 inches wide, with a 1- inch tuck, and machine-sewn with no selvage material visible from front of curtain. Sew open ends of hems closed.
2. Leading Edge Turnbacks: Where specified, provide turnbacks formed by folding 12 inches of face fabric back with a 1-inch tuck and secured by sewing the turnback vertically.
3. Top Hems: Reinforce top hems by double-stitching 3 1/2 inch wide, heavy jute webbing to top edge with minimum 2 inches of face fabric turned under.
4. Pleats: Provide fullness in curtains by sewing additional material into 6-inch double-stitched box pleats spaced at 12 inches o.c. along top hem reinforcing. Provide not less than No. 2 brass grommets, centered on box pleats, for tie lines or S hooks. Arrange vertical seams so that they do not fall on faces of pleats. For velour curtains provide not less than No. 3 grommets. For black curtains provide grommets with a black anodic finish.
5. Bottom Hems: For curtains that do not hang to the floor, provide hems not less than 3 inches deep with 3/4 inch weight tape. For floor-length curtains, provide hems not less than 6 inches deep with 1-inch weight tape. Sew open ends of hems closed.
6. Lining: Provide lining for each curtain in same fullness as face fabric, and finished 2 inches shorter than face fabric. Unless otherwise specified, provide lining constructed of same fiber type as face fabric. Attach lining to face fabric along bottom and side seams with 4 inch long strips of heavy woven cotton tape.

2.5 METAL

A. Steel Pipe: ASTM A 53, Grade A, black, standard weight (Schedule 40), 1 1/2 inch nominal diameter, unless otherwise indicated.

B. Galvanized Steel Sheet: Zinc-coated carbon steel sheet of commercial quality, complying with ASTM A 526, G60 zinc coating; 0.075 inch (14 gage) minimum nominal thickness.

C. Support, Clamps, and Anchors: Sheet steel in manufacturer's standard gages, galvanized after fabrication according to ASTM A 153, Class B.

D. Support Chain: ASTM A 413, 1/4 inch size, not less than 0.276 inch material diameter.

E. Inserts, Bolts, and Fasteners: Manufacturer's standard units.

2.6 CURTAIN TRACK - STRAIGHT

A. Steel Tracks, General: Fabricate of not less than 0.075 inch (14 gage) nominal thickness galvanized roll-formed steel, with continuous bottom slot and with each half of track in one continuous piece.

1. Provide curtain carriers for track spaced at 12 inches o.c.

B. Heavy-Duty Track (Front Setting Curtain): Equip track with heavy-duty live-end double pulley and heavy-duty dead-end single pulley, with 5 inch cast-iron or nylon wheels on ball bearings, enclosed in steel housings. Provide curtain carriers of molded nylon with a pair of neoprene or nylon tired ball bearing wheels riveted parallel to body. Equip carriers with neoprene or rubber bumper, heavy-duty swivel eye, and trim chain for attaching curtain snap or S hook. Provide end stops for track and adjustable floor block designed to maintain proper tension on 3/8 inch stretch-resistant operating line of braided polypropylene or fiberglass center cord.

C. Products: Subject to compliance with requirements, provide one of the following:

D. Silent Steel Model No. 280, Automatic Devices Company

1. Tru-Roll Model No. 1000, Grosh Scenic Studios, Inc.
2. Atlas Silk Model No. 400, H & H Specialities, Inc.

2.7 CURVED CURTAIN TRACK FABRICATION (CYCLORAMA/INTERMEDIATE SETTING/ T.V. STUDIO CURTAINS)

A. General: Fabricate curved curtain tracks for walk-along operation without cord or pulleys, designed for rigid attachment to ceiling or hanging clamps.

B. Steel Track: Fabricate of not less than 0.075 inch (14 gage) nominal thickness galvanized roll-formed steel, with continuous bottom slot. Provide curtain carriers of plated or rustproof steel with pair of polyethylene wheels fastened parallel to body by rustproof steel rivets. Equip carriers with swivel eye for attaching curtain snap or S hook.

C. Available Products: Subject to compliance with requirements, curved tracks that may be incorporated in the work include, but are not limited to, the following:

1. Besteel Model No. 1754 Curve, Automatic Devices Company
2. Atlas Silk Model No. 154 Curve, H & H Specialties, Inc.

D. Use in combination with a medium duty straight track.

PART 3 - EXECUTION

3.1 PREPARATION

A. Furnish layouts for inserts, clips, or other supports required to be installed by other trades to support tracks and battens.

3.2 INSTALLATION, GENERAL

A. Install materials according to manufacturer’s printed instructions and recommendations.

3.3 BATTENS

A. Fabricate battens from steel pipe with a minimum number of joints. As necessary for required lengths, connect pipe with a drive fit pipe sleeve not less than 18 inches long and secure with four flush rivets, plug welds, threaded couplings, or another equally secure method. Shop paint completed pipe battens with black paint to comply with Section 09910.

1. TV Studio - Fabricate a 5'-0” x 5'-0” pipe grid with overall size 15'-0” x 20'-0”, centered in room. Provide matching fittings at all pipe intersections.

B. Install battens by suspending at proper heights with steel chains or cables spaced at not more than 10 feet o.c.

C. Secure chains either directly to structures or to inserts, eye-screws, or other devices that are secure and appropriate to substrate, and that will not deteriorate or fail with age or elevated temperatures. Coordinate suspension penetrations with suspended ceiling, neatly working grid and cut ceiling tile around and tight to chains/hangers.

3.4 TRACK INSTALLATION

A. Wall Mounted Tracks: Install tracks by suspending from manufacturer's special bracket clamps securely mounted to wall construction at recommended spacing.

B. Batten-Hung Tracks: Install track by suspending from pipe batten with manufacturer's special pipe clamps at recommended spacing.

C. Heavy-Duty Track: Do not exceed 6 feet between supports.

D. Medium-Duty Track: Do not exceed 4 feet between supports.

E. Curved/Walk-Along Track: Do not exceed 4 feet between supports, and provide additional supports at curves and splices.

F. Install track for center-parting curtains with not less than a 2 foot overlap of track sections at center, supported by special lap clamps.

3.5 CURTAIN INSTALLATION

A. Track-Hung: Secure curtains to track carriers with track manufacturer's special heavy duty S hooks for snap hooks.

B. Batten Hung: Secure curtains to pipe battens with minimum 5/8 inch wide by 36 inch long braided soft cotton tie lines.

END OF SECTION 11 61 45

SECTION 11 66 00
ATHLETIC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following

1. Indoor and Outdoor Athletic equipment:

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, features, and finishes. Include details of anchors, hardware, and fastenings. If applicable, include assembly, disassembly, and storage instructions.

1. Gymnasium Equipment Operators: Include operating instructions.
2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
3. Maintenance data

B. Shop Drawings: Show location of equipment. Show method of field installation, operational clearances, and relationship to adjoining work.

1. Show locations of blocking and reinforcement required for support of equipment.
2. Setting Drawings: For cast-in floor insert sleeves for post standards.

C. Pre-Installation Conference Minutes: Submit minutes in accordance with indicated requirements.

D. Warranty: Submit draft copies of warranties as herein indicated.

E. Submit signed and sealed shop drawings by a registered engineer in the State of Florida for all exterior concrete footings for basketball and tennis posts.

F. Closeout submittals for Scoreboards

1. Deliver two (2) bound sets of operational and maintenance instructions to OWNER.

1.4 REFERENCES

A. All equipment specified herein shall conform to the latest rules and regulations of the National Federation of State High School Association (NFSHSA), including National Federation of State High School Associations, Court and Field Diagram Guide. Indianapolis, Indiana 46206, 2002.

B. Applicable Publications

1. Department of Community Affairs

a. Florida Americans with Disability Implementation Act.
b. Occupational Safety and Health Administration, U.S. Department of Labor, 29 CFR

1.5 QUALITY ASSURANCE

A. Contractor Qualifications: Employ only experienced Contractors (Installers) skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five (5) years. Installers shall be state-certified or licensed Sub-Contractors.

B. Manufacturer Qualifications: Employ only manufacturers with not less than five (5) years' experience making the specified materials as a current catalog and regular production item.

C. Source Limitations: Provide products of the same manufacturer for each type of unit specified, as much as possible, to have a one source warranty contact.

D. All exterior concrete footings for basketball and tennis shall be designed by a registered structural engineer in the State of Florida and shop drawings shall include as such.

E. Installer Qualifications: A qualified installer employing workers trained and approved by manufacturer.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify position and elevation of floor inserts and layout for athletic equipment. Verify dimensions by field measurements.

1.7 COORDINATION

A. Coordinate with Divisions 23 and 26 contractors for installation of the physical education equipment. Also coordinate with the Architect for exact locations.

1.8 WARRANTY

A. Provide manufacturer's standard warranty on all sports and physical education equipment from the date of substantial completion as stated in this specification.

B. Special Warranties

1. Electric Backstop Winch: Five-year replacement warranty.
2. Glass Backboard: Limited Lifetime warranty.

3. Master equipment Controller (MEC Pad): Three-year replacement warranty.

PART 2 - PRODUCTS

2.1 INDOOR ATHLETIC EQUIPMENT

A. Competition Court Basketball Goals: Breakaway goals, spring-loaded, self-resetting.

1. Basis of Design Product and Manufacturer; Porter Model 204, or a comparable product by one of the following:

a. Draper, Inc.
b. Jaypro.
c. Performance Sports Systems.

2. Backboard, Glass: Rectangular 6’-0” x 3’-6” (shatterproof) with “Clear Defense” applied to the glass and safety padding.

B. Basketball Support Structure:

1. Basis of Design Product and Manufacturer; Porter Model 90917000, or a comparable product by one of the following:

a. Draper, Inc.
b. Jaypro.
c. Performance Sports Systems.

2. Ceiling suspended, forward fold, rear braced.

C. Basketball Electric Winch:

1. Basis of Design Product and Manufacturer; Porter Model 713, or a comparable product by one of the following:

a. Draper, Inc.
b. Jaypro.
c. Performance Sports Systems.

2. Operable equipment in the gym shall have handheld remote for maintenance.
3. When operable equipment in the gym has a wall switch, the switch shall be a double throw switch instead of a key. The wall switch shall be placed within a lock box.

D. Basketball Backboard Safety Lock:

1. Basis of Design Product and Manufacturer; Porter Model 10797-100, or a comparable product by one of the following:

a. Draper, Inc.
b. Jaypro.
c. Performance Sports Systems.

E. Basketball Fixed Goals:

1. Basis of Design Product and Manufacturer; Porter Model 00225000, or a comparable product by one of the following:

    a. Draper, Inc.
    b. Jaypro.
    c. Performance Sports Systems.

2. Shall include:

    a. Net: Manufacturers standard nylon net

F. Basketball Breakaway Goals:

1. Basis of Design Product and Manufacturer; Porter Model 236054, or a comparable product by one of the following:

    a. Draper, Inc.
    b. Jaypro.
    c. Performance Sports Systems.

2. Shall include:

    a. Net: Manufacturers standard nylon net.

G. Wainscot Wall Panels:

1. Basis of Design Product and Manufacturer; Porter Competition Pads, Model 00326, or a comparable product by one of the following:

    a. Draper, Inc.
    b. Jaypro.
    c. Performance Sports Systems.

2. Size: As indicated.
3. Wall Pads shall meet Surface-Burning Characteristics in ASTM E84-01.
4. Color: As selected by Architect from Manufacturers full range.

H. Scoreboards:

1. Basis of Design Product and Manufacturer; Daktronics Model BB-2103-13, or a comparable product by one of the following:

    a. Fair-Play.
    b. Nevco.
    c. Varsity Scoreboards.

2. Size: 6’x8’x6”
3. LED Numerals 13”.
4. Wireless remote-control console with battery pack.

I. Shot clock/ shot timer:

1. Basis of Design Product and Manufacturer; Daktronics Model BB-2114, or a comparable product by one of the following:

a. Fair-Play.
b. Nevco.
c. Varsity Scoreboards.

2. Size: 26” x 26” x 8”.
3. LED Numerals 13”
4. Manufacturers standard mounting for backboard, coordinate mounting with backboard selected.

J. Volleyball:

1. Basis of Design Product and Manufacturer; Porter Powr-Net, or a comparable product by one of the following:

a. Schelde.
b. Draper, Inc.

2. Shall include all necessary components for a fully operational and functional system, and the following:

a. Fold-up Structure including Mast, Structure Pipes, and Ceiling attachments.
b. Judges Stand including Platform and ladder.
c. Net Strap.
d. Tie-off rods.
e. Volleyball net.
f. Electric Height Adjusters.
g. Net Antennae.
h. Safety Straps.
i. Pulleys, Hinges.
j. Winches, Height Adjuster Motors, Control Systems.
k. Padding.

K. Floor-Set Volleyball:

1. Basis of Design Product and Manufacturer; Porter Powr-Rib II, or a comparable product by one of the following:

a. Schelde.
b. Draper, Inc.

2. Shall include all necessary components for a fully operational and functional system, and the following:

a. Upright.
b. Upright w/ winch.

1) Uprights shall be adjustable for badminton and tennis.

c. Floor Sleeves.
d. Brass Floor Plates.
e. Pole Pads.
f. Net.
g. Referee Stand.
h. Antennas & side markers.

i. Cable Covers.

2.2 OUTDOOR EQUIPMENT

A. Tennis

1. Basis of Design Manufacturer; Porter.

a. Posts: Model 00865-300.
b. Net: 3’-3” x 42”-0,” nylon w/ tension cable.
c. Sleeves: 00430-000.

2. Or subject to compliance with requirements, a comparable product by one of the following:

a. Draper.
b. Performance Sports Systems (PSS).

B. Wind Baffle for Chain-Link Fence at playcourts.

1. Welch Model Durascreen 80%.
2. Height: 6’-0”.
3. Fabric: Open Mesh vinyl impregnated polyester.
4. Color: Green.

C. Football Goal Posts (permanent) 2 thus.

1. Basis of Design Product and Manufacturer; Draper 505122.

a. Height of Cross bar: 10’-0” above grade (top edge)
b. Length of Crossbar: 23’-4”
c. Width of Uprights: 4” max
d. Length of Uprights: 10’-0” above crossbar
e. Padding: Goal Posts shall be padded with resilient shock absorbing material to a height of at least 6’-0” above the ground, vinyl covered, 3” thick and Velcro attached.

2. Or subject to compliance with requirements, a comparable product by one of the following:

a. Porter.
b. Performance Sports Systems (PSS)

3. Model 02960366 (same accessories as above).

D. Player Bench / Football and Soccer

1. Porter Model 00071-511 x 15 ft. length, portable with permanent mounted backs. Seat to be 10" wide x 2" deep clear anodized aluminum extrusions, supported by galvanized steel angle brackets and 1 7/8" O.D. galvanized posts at 5'-0” o.c. maximum spacing.
2. Provide eight benches, locations if not shown, will be instructed.

E. Basketball

1. Basis of Design Product and Manufacturer; Porter Model 00175-330.

    a. Backboard: Fan Aluminum
    b. Poles: 4- ½" diameter with 5'-0" gooseneck extension.
    c. Padding: 6'-0" high above grade.
    d. Goal: Double Rim
    e. Net: Nylon by Manufacturer.

2. Or subject to compliance with requirements, a comparable product by one of the following:

    a. Draper
    b. Performance Sports Systems (PSS)

F. Baseball/ Softball

1. Bases 1st, 2nd, 3rd, home plate and pitchers mound.

    a. Schutt Sports.
    b. Regent Sports.

G. Soccer Goals 24' x 8' x 3'-8"

1. Tomark Model 50314 w/ net
2. Draper Model 505006 w/ net
3. Porter Model 467100
4. Provide with each goal with goal transport systems, fully installed.

    a. Provide two (2) pair each goal.

H. Foul Poles with Expanded Mesh Bolt-on Wing panels.

1. Baseball:

    a. Porter Model 330003CXX.
    b. In-Ground Sleeve Mount: Part No. 330013.
    c. Height: As indicated.
    d. Diameter: As indicated.
    e. Color: As selected by Architect from Manufacturers full range.

2. Softball:

    a. Porter Model 330002CXX.
    b. In-Ground Sleeve Mount: Part No. 330012.
    c. Height: As indicated.
    d. Diameter: As indicated.
    e. Color: As selected by Architect from Manufacturers full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, and other conditions affecting performance.

1. Verify critical dimensions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions. Complete equipment field assembly, where required.

B. Permanently Placed Athletic Equipment and Components: Rigid, level, plumb, square, and true; position at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout.

C. The athletic equipment installation shall only be done by the Manufacturers approved contractor. The contractor shall have received training from the Manufacturer on the installation of the equipment and on the maintenance of the equipment.

D. Floor Inserts shall be set in concrete slabs. Clean voids of debris. Fill void around sleeve with grout. Verify that sleeves are set plumb, aligned, and at correct height and spacing. Insert shall be set so the top cover surface is flush with the finished floor surface.

E. Mount wall panels with bottom edge 4” above finish floor.

3.3 SPECIAL INSTALLATION PROCEDURE / ADJUSTMENT PROCEDURES

A. Tolerances that are listed in the National Federation of State High School Associations be complied with and certified by the installation contractor. Provide all items and accessories as required for a total and complete installation in every respect.

B. Operational Training

1. Engage a Manufacturer’s authorized service representative to train school personnel and Maintenance personnel on the adjustment and correct operation and preventive maintenance of the Athletic Equipment. This shall be done in a classroom instructional course. After the classroom instruction the manufacturer will conduct an operational seminar in the Gymnasium or at the court or playing field, to show a hands-on operation, care and maintenance of the equipment.

C. Adjusting

1. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily and quietly, free from binding, warp, distortion or malfunction, throughout the entire operational range. Lubricate hardware and moving parts.

D. After pavement work is completed, accurately locate positions of embedded items, then neatly sawcut pavement, sized to required concrete encasement. Excavate to minimum size and depth listed herein. Position embedded item in exact required location, fully supported in position until concrete has reached required strength to support same in its final position. Place Division 3 concrete around each item, sloping top of concrete to drain away from embedded item. Float concrete smooth. After concrete has cured, coat concrete with “black” seal coat to approximate color of asphalt.

E. Basketball goal post footing to 30" dia. by 3'-6" deep with 3'-0" minimum embedment of posts, or greater footing size if recommended by manufacturer.

F. Volleyball Sleeves: Locate and size footings as indicated on drawings.

G. Individual Fixed Tennis Post: footing to be 24" diameter by minimum 3'-6" deep.

H. Tennis Tie Down Anchor: size footing 6" x 6" x 15" deep minimum (or 3" greater than anchor length).

I. Player Bench: Portable player benches 15’ long x 10” wide with backs.

J. Other fixed equipment is to be set in concrete footings no less than 12" dia. + embedded post dia. with minimum 3" concrete cover at bottom of post, or as detailed or otherwise required by manufacturer if greater than the foregoing requirements.

K. Removable poles are to be set in position to demonstrate correct installation to ARCHITECT and OWNER, then remove and store in secure space designated by ARCHITECT and set cover plates in sleeves. Sleeve shall not hold water after installation.

L. Game line painting (basketball, volleyball, tennis, other) is specified in Section 11 66 10 “Track and Court Surfacing.”

M. Verify exact locations of each piece of equipment with ARCHITECT prior to setting in place.

3.4 CLEANING AND PROTECTION

A. After completing equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

B. Provide final protection and maintain conditions acceptable to manufacturer and Installer that ensure equipment is without damage or deterioration at time of Substantial Completion.

C. Replace equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 11 66 00

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SECTION 11 66 10
PLAY COURT SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This standard establishes minimum requirements for play court surfaces.

1.3 REFERENCES

A. Applicable Standards:

1. National Federation of State High School Associations Court and Field Diagram Guide, Indianapolis, Indiana, current edition.
2. The National Federation State High Schools Association Court and Field Diagram Guide.
3. FDOT 2007 Standard Specifications.

1.4 REFERENCES

A. Applicable Standards:

1. National Federation of State High School Associations Court and Field Diagram Guide, Indianapolis, Indiana, current edition.
2. The National Federation State High Schools Association Court and Field Diagram Guide.
3. FDOT 2007 Standard Specifications.

B. Applicable Publications:

1. State Requirements for Educational Facilities.
2. Department of Community Affairs.

    a. Florida Americans With Disability Implementation Act.
    b. Occupational Safety and Health Administration, U.S. Department of Labor, 29 CFR.
    c. Florida Building Code, current edition.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's standard, product data for each required type of product.

B. Sample for initial selection:

1. Provide sample of court paint and line painting for all colors and textures from the Manufacturers full range.

C. Sample for Verification:

1. Samples of colors and textures as approved by the Architect as selected from Manufacturers full range.

1.6 QUALITY ASSURANCE

A. Contractor Qualifications: Employ only experienced Contractors (Installers) skilled in the successful installation of and play court surfacing/coatings (exclusive of road paving contractors) for a minimum of five (5) years.

B. Hot-mix asphalt shall meet the FDOT requirements for Type S-3 asphalt.

C. Calculations shall be guaranteed accurate. Hot mix asphalt shall meet the FDOT requirements for Type S-3 asphalt.

1.7 WARRANTY

A. Contractor's Warranty: Provide written warranty that base course and finish surfacing materials for play courts shall not crack, deteriorate, blister or delaminate for indicated warranty period.

1. Warranty Period: Not less than one year from date of substantial Completion.

PART 2 - PRODUCT SYSTEM

2.1 HARDCOURT CONSTRUCTION

A. The base and sub base for all hardcourts shall be as recommended by the Civil Engineer, based on the Geotechnical Engineer's report on existing soil conditions.

B. The top course of asphalt shall be Type S-3 (or equal) hot-mix asphalt in accordance with National Federation State High Schools Association standards and specifications. Minimum allowable thickness shall not to be less than one (1) inch.

C. All courts shall have a textured coating of fibrated asphalt/acrylic emulsion manufactured with graded rubber particles, fine silica sand and fillers. Fortified with acrylic latex suitable for spray application.

2.2 EXTERIOR ASPHALT COURT COATING

A. 100% acrylic emulsion resurfacer designed for on-site mixing with silica sand.

1. Basis of design Products and Manufacturer: Sportmaster Acrylic resurfacer, ThorWorks Industries, Inc., subject to compliance with requirements, available manufacturers that may be incorporated into the Work include:

B. Subject to compliance with requirements, other acceptable Manufacturers offering products which may be incorporated into the work are but not limited to the following:

1. Latex-ite International Incorporated.
2. Plexipave as Manufactured by California Products Corp.
3. CourtMaster Recreational Surface.

C. Application: Two coats over prepared substrates.

D. Color: Custom to match Architect's samples.

E. Coverage Rate: Comply with manufacturer's requirements for substrates indicated.

F. Line Paint.

1. High reflective paint for use over bituminous surfaces, concrete and color coating system acceptable to Manufacturer of Court Paint and matching Architects sample.

PART 3 - EXECUTION

3.1 ASPHALT APPLICATION

A. Hot-mix asphalt pavement should be placed with a self-propelled asphalt paver. The screed width should be adjustable to no less than eight feet (8'). Only hydraulic screed and auger extensions to achieve widths greater than that of the main screed are acceptable.

B. Compaction equipment should consist of steel drum asphalt rollers of sufficient size and width to properly compact the hot mix asphalt to the required compaction, while providing a smooth surface free from bumps, marks, and creases, and indentations at seams.

C. Contractor shall furnish and maintain at the site, in good working condition, one 10' straightedge for each paver.

D. Hot mix asphalt courses should only be placed on specified base, free from contamination and no free water on the surface.

E. Temperature ranges for mixtures to be dumped into paver should be determined by FDOT specifications and in no case should be cooler than 225 degrees F.

F. Paving operations shall provide a mat that is smooth, dense, and of the proper thickness, slope and planarity as per FDOT specifications.

G. Leveling course shall be placed so that longitudinal joints of the leveling course are offset from that of the base course. Transverse joints should be offset a minimum of 24''.

H. In placing each succeeding pass after the initial one, paver screed should be set so that it overlaps the preceding pass by 2'' and sufficiently high so that when compacted, a smooth joint is produced. Prior to pinching the joint, the excess material shall be pushed onto the edge of the new pass with a lute. Excess material should be removed and wasted.

I. Breakdown rolling should begin as soon after the placement as the mixture will allow without undue displacement. No delays in rolling should be permitted. After breakdown rolling has been completed, preliminary testing of grade, slope and planarity should be done. Any deficiencies should be immediately corrected. When the paving contractor is assured that all tolerances are being met, finish rolling should begin.

J. Deficient areas within the base course should be corrected by saw cutting or milling high spots and /or by truing and leveling low spots.

K. Deficient areas in the base or leveling course should be corrected by saw cutting or milling to a depth equal to the thickness of the mat. Tack coat shall be applied to all edges and the pavement should be replaced. Skin patching of the leveling course shall only be done with materials acceptable to the surfacing contractor.

L. Apply playing lines, 2-inch wide, in accordance with the manufacturers written installation instructions.

3.2 ACCEPTABILITY OF WORK

A. Grade conformance tests shall be conducted on the entire surface, and the entire surface should have positive drainage.

B. After completion of finish rolling operations of each course, the compacted surface shall be tested with a 10' straightedge. Measurements should be made perpendicular to and across all mats at a distance not to exceed 25 feet. The surface must be free of dips, seam and/or joint depressions, and cracks. The surfacing contractor shall be present when these measurements are made. The maximum allowable planarity deviation within a pass should be 1/8" in 10' when measured in any direction.

C. The play court when completed, and before striping, shall be completely free from blemishes, patching scars, and have a uniform finish and color.

3.3 EXAMINATION FOR APPLICATION OF TOPPING

A. The exterior surface shall be inspected for existing surface conditions before application of acrylic surfacer.

B. Any cracks shall be filled with a product that is approved by the acrylic surfacer manufacturer.

C. Birdbaths or depressions greater than 1/2" in the surface shall be filled in using an acrylic patch mix before acrylic surface is applied.

D. If the surface is, by inspection, having trouble with surface drainage or sub-surface hydrostatic pressure these conditions should be brought to the attention of the Architect and the problem corrected before application of the acrylic surfacer is begun.

3.4 INSTALLATION ENVIRONMENTAL CONDITIONS - TOPPING

A. The surface of the play-court shall be within the ambient temperature range recommended by the Manufacturer, which is usually from 50 degrees F to 140 degrees F.

B. The acrylic surfacer must be dry, (drying time as recommended by the Manufacturer) before any rain-water hits the application.

C. The acrylic surfacer shall be dry before any foot traffic is allowed on the surface.

D. Do not apply any paint until the surface is dry.

3.5 INSTALLATION PROCEDURES/ADJUSTMENT PROCEDURES - TOPPING

A. The acrylic surface is batch mixed at the site for the specific condition. All mixing shall be in accordance with the Manufacturers written instructions and by an approved Manufacturers applicator.

B. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of any items indicates all conditions are satisfactory and acceptance of previous Work by other Contractors.

3.6 TOPPING APPLICATION

A. The batch mixing of acrylic resins, mineral fillers, color pigments and aggregate shall be done at the job site using the Manufacturers written instructions.

B. The surface shall be thoroughly cleaned, removing dirt, dust, oil, leaves and other foreign debris.

C. Courts should be flooded with water to find low areas. After 1-hour drying time any areas that hold water greater than 1/2” shall be patched with an acrylic patch mix.

D. All cracks 1/8” and larger shall be cleaned and filled with an acrylic crack filler.

E. Machine grind the entire slab to remove bumps and loose material.

F. Coating system:

1. The acrylic system shall be applied using squeegees.
2. The first coat of acrylic surfacer shall cover .04 to .08 gallons per square yard.
3. The second and third coats of acrylic color with aggregate shall cover .04 to .05 gallons per square yard.
4. There shall be a two-coat paintbrush application of acrylic line paint. Do not paint the lines until the acrylic surface has dried.

3.7 TOPPING DRYING TIME

A. Allow 30-90 minutes for the applied acrylic surfacing to dry.

END OF SECTION 11 66 10

SECTION 11 68 43
EXTERIOR SCOREBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work of this Section includes outdoor athletic scoreboards.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's standard product data for each required type of scoreboard.

1. Include manufacturer's operation and maintenance instructions for each type of scoreboards specified herein.

B. Shop drawings: Indicate the model number, type of material, gauges or thickness of metal, finishes and details of construction, and attachment.

C. Warranty: Submit warranties as specified herein.

1.4 PROJECT CONDITIONS

A. Loose items of equipment shall be turned over to the Owner after unpackaging or uncrating, and checking for proper type, material, size, and fit of each accessory. Obtain receipt from Owner for items turned over. No claim may be made for items turned over to the Owner without obtaining a receipt.

1.5 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard warranty on all scoreboards that units are and will remain free of defects in materials and/or workmanship for the indicated warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements; provide one of the following:

1. Daktronics, Inc., Baseball/Softball Board: BA-624-11.
2. Eversan, Inc., Baseball/Softball Board: 9275.
3. Scoretec, Baseball/Softball Board: 5160.

B. Approximately 14 ft. w x 6 ft. h

C. Standard features include: score, inning, ball, strike, out, hit and error.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Inspect both the substrate and conditions under which Work is to be performed.

1. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Inspect materials or equipment immediately upon delivery and again before installation. Reject damaged and defective items.

C. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level.

1. Allow for expansion and building movement.

D. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

E. Recheck measurements and dimensions, before starting each installation.

F. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

G. Install in accordance with manufacturer's written installation instructions.

3.2 PROTECTION

A. Protect accessories against damage during remainder of construction period, complying with manufacturer's directions.

END OF SECTION 11 68 43

SECTION 11 94 13
MISCELLANEOUS EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Requirements for Equipment as indicated on the Equipment Schedule.
2. Paint Hood.
3. Concealed wall mounted counter brackets.

1.3 SUBMITTALS

A. Product Data: Include material descriptions, dimensions, profiles, fastening and mounting methods, and finishes for equipment specified.

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of equipment or unit and for units exposed to view in same areas, unless otherwise approved by Architect.

1.5 COORDINATION

A. Coordinate equipment locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing.

1.6 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Warranty: Written warranty, executed by the individual equipment manufacturer agreeing to replace defective units.

1. Minimum Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS EQUIPMENT

A. Paint Hood:

1. Model and Manufacturer - Basis of Design: Diversified Woodcrafts, Model 8200M (ADA Accessible).

a. 1/3 Horsepower motor requires a 125 volt, 20 amp circuit hard wired into a junction box. External junction box not included
b. Size: 36"W x 24"D x 97-3/4"H
c. Solid Maple and Maple Veneer Construction
d. Locking double doors and one adjustable shelf for added storage
e. Fabricated of 18 gauge steel with corrosion resistant, powder coat baked epoxy finish,

B. Concealed wall mounted counter brackets.

1. Basis of Design Product and Manufacturer; RAKKS, Model Inside Wall mounted brackets.

a. Size: 18-inches x 18-inches.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment units according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by the manufacturer. Install equipment units level, plumb, and firmly anchored in locations and at heights indicated.

B. Verify that materials are those specified before installing.

C. Install accessories after other finishing operations, including painting, have been completed.

3.2 PROTECTION

A. Comply with manufacturer’s written recommendations and directions to protect accessories against damage during remainder of construction period and until Date of Substantial Completion.

B. ADJUSTING AND CLEANING

C. Adjust equipment units for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

D. Remove temporary labels and protective coatings.

E. Clean exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 11 94 13

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SECTION 11 95 13
KILNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Kilns.
2. Kiln related shelving unts.

1.3 SUBMITTALS

A. Product Data: Include material descriptions, dimensions, specified options, and finishes for equipment specified.

1. Include installation instructions.
2. Include operating and maintenance data.

B. Shop Drawings: Indicate roughing-in dimensions.

1.4 QUALITY ASSURANCE

A. Contractor qualifications: Employ only experienced Contractors (Installers) skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five (5) years.

B. Manufacturer Qualifications: Employ only manufacturers with at least five (5) years experience making the specified materials as a current catalog and regular production item.

C. Source Limitations: Unless specifically noted otherwise, provide products of the same manufacturer for each type of unit specified.

1.5 COORDINATION

A. Coordinate equipment locations with other work to prevent interference with clearances required for access, proper installation, adjustment, operation, cleaning, and servicing.

1.6 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Warranty: Written warranty, executed by the individual equipment manufacturer agreeing to replace defective units.

1. Minimum Warranty Period: Two years from date of Substantial Completion.

C. Installer's Warranty: Written warranty, executed by the installer agreeing to replace defective units.

1. Minimum Warranty Period: One year from date of Substantial Completion.

1.7 COMMISSIONING

A. Field Reports

B. (Independent) Acceptance Testing/Participants

C. Contractor Statement of Compliance: Contractor shall provide certification that the specified fire-rated products or assemblies have been installed in accordance with the Project Construction Documents.

PART 2 - PRODUCTS

2.1 KILNS

A. Description: Electric Ceramic, 10-sided firing chamber. Cone 8 rating, Dawson Kiln Sitter and limit timer. Front controls. Stainless steel case. Adjustable case clamps, peep holes, protective aluminum base plate, pilot light, safety timer, back-up shutoff device.

B. Basis of Design Product and Manufacturer; Model: Jen Ken Model JK-2431, subject to compliance with requirement other Manufacturers offering products which may be incorporated into the work are:

1. Paragon Kilns: Dragon.
2. Euclid Kilns: CF 255.
3. L & L Kilns.

C. Component Performance Characteristics:

1. Certified to CSA & U.L. Standard 499.
2. Front loading with stand (Minimum 24” high).
3. Minimum of 3” firebrick.
4. Warranty: Two years, parts and labor.
5. Color: Manufacturers standard color.

2.2 ACCESSORIES

A. Ceramic peep hole pls (vent plugs) to be provided with each Kiln.

2.3 FABRICATION

A. Kiln and components shall be shipped as a complete unit. Base shall be attached to the bottom of the kiln. Controls shall be installed.

2.4 KILN METAL SHELVING

A. Global Industrial Equipment, Model No. CG331380, wire shelving 12" deep x 36" wide individual sections x 63" high with five shelves each section, black matte epoxy finish. Furnish extra hardware for fifth shelf and back and side ledges for all shelves.

PART 3 - EXECUTION

3.1 PREPARATION

A. Specified items shall not be delivered or installed until building is enclosed, wet work completed and HVAC system is operating and maintaining temperature and humidity at occupancy level during remainder of construction period.

3.2 INSTALLATION

A. General: Install equipment units according to manufacturers' written instructions and recommendations. Install equipment units level, plumb, and firmly anchored.

1. Provide all items and accessories as required for a total and complete installation.

B. Provide all items and accessories as required for a total and complete installation in every respect.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of any items indicates all conditions are satisfactory and acceptance of previous Work by other Contractors.

3.3 OPERATIONAL TRAINING

A. Engage a Manufacturers’ authorized service representative to train staff in the proper operation and maintenance of the kiln to include cleaning, sidewall, element and door maintenance and proper use of controls.

B. Training shall be done in a classroom with instructional presentation by the Manufacturer’s representative. After the presentation is made, a kiln room instruction on proper kiln operation shall be made, to include proper “burn-in”, kiln clearances, storage for unfired and fired ware and venting requirements.

3.4 ADJUSTING AND CLEANING

A. Adjust equipment units for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean exposed surfaces according to manufacturer's written instructions and recommendations.

D. After completing the installation of the kiln, remove all package crating, remove from jobsite and legally dispose of it. Kiln shall be cleaned of all spots, dirt and debris.

END OF SECTION 11 95 13

Division 12

Furnishings

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SECTION 12 21 13
HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Horizontal louver blinds with aluminum slats.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For horizontal louver blinds, include fabrication and installation details.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet-work and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 WARRANTY

A. Provide Manufacturers lifetime warranty. Shall start at date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.

2.2 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

A. Subject to compliance with requirement provide products by one of the following:

1. CACO, Inc., Window Fashions.
2. Hunter Douglas Contract.
3. Levolor Contract; a Newell Rubbermaid company.
4. Springs Window Fashions; SWFcontract.

B. Headrail: Manufacturer's standard headrail, 1” X 1” channel shaped section fabrication from minimum 0.024 inch thick sheet steel. Increase metal thickness as recommended by the manufacturer for larger blind units. Cross brace for extra rigidity. Furnish complete with tiling mechanism, top and end brace, top cradle, cord lock, and accessory items required for the type of blind and installation indicated.

C. Bottom Rail: Manufacturer's standard steel bottom rail, designed to withstand twisting or sagging. Contour top surface to match slat curvature, with flat or slightly curved bottom. Close ends with manufacturer's standard metal or plastic end caps, of the same color as rail. Finish rail the same color as slats, unless otherwise indicated.

D. Slats: Manufacturer's standard, spring tempered, one inch aluminum slats not less than 0.008 inch thick, (louver blades), with rounded corners and forming burrs removed.

E. Braided Ladders: Manufacturer's standard polyester support cords with integrally braided ladder rungs. Provide cord size and rung spacing as required for each type of blind.

F. Tilter: Manufacturer's standard enclosed, lubricated, tilting mechanism which will tilt and securely hold the tilting rod, slats, and bottom rail at any set angle. Furnish wand (or rod) type tilter consisting of standard tilter mechanism adapted for rotating wand operation. Furnish manufacturer's standard plastic or aluminum rod of proper length of suit blind installation.

G. Tilt Rod: Manufacturer's standard; as selected byte Architect, provide one of the following: Electro-zinc coated steel tubing, ¼-inch square, or clear polycarbonate Hexagonal approximately ¼-inch diameter.

H. Color: As selected by Architect from Manufacture's full range.

2.3 ACCESSORIES

A. Provide installation hardware, fasteners, hooks, and other miscellaneous items required for a finished and complete installation.

2.4 HORIZONTAL LOUVER BLIND FABRICATION

A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch. Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch, plus or minus 1/8 inch.

C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.

E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

F. Color-Coated Finish:

1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
2. Wood: Apply manufacturer's standard factory-applied finish complying with manufacturer's written instructions for surface preparation, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.

1. Locate so exterior slat edges are not closer than 1 inch from interior faces of glass and not closer than 1/2 inch from interior faces of glazing frames through full operating ranges of blinds.
2. Install mounting and intermediate brackets to prevent deflection of headrails.
3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.3 ADJUSTING

A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

A. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

END OF SECTION 12 21 13

SECTION 12 24 13
ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated roller shades.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified.

D. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUALLY OPERATED SHADES

A. Basis-of-Design Product: Subject to compliance with requirements, provide MechoShade Systems Inc, Mecho/5 Manual Shade; or a comparable product by one of the following:

1. Draper Inc.
2. Hunter Douglas Contract.
3. Lutron Electronics Co., Inc.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Chain tensioner, jamb mounted.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.

1. Provide Mechoshade Brand Slimline Brackets.

D. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.

1. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criterion is more stringent.

2.2 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Basis of Design Product and Manufacturer; Mechoshade, ThermoVeil Basket Weave.

1. Color: As selected by Architect from Manufacturer’s full range.
2. Opacity: 10% Shading.

C. Shadebands:

1. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum, Exposed with endcaps and integral light seal at bottom where it meets the sill.

a. Type: Enclosed in sealed pocket of shadeband material.

D. Installation Accessories:

1. Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

    a. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open.

2. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.

    a. Color: White.

3. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
4. Installation Accessories Color and Finish: Clear Anodized.

2.3 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1.

B. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13

SECTION 12 35 53
LABORATORY CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work of this Section includes the following:

1. Science casework
2. Science casework counter tops

B. This Work includes special and stock design pre-assembled units for installation as movable and fixed.

C. The catalog numbers of the manufacturer listed on the Science Casework Schedule are intended to include a complete item, as the catalog number is published in the manufacturer's current catalog. Although the description in the schedule is brief, the item shall be provided complete with hardware, accessories, features, and components.

D. Fixtures and Trim: Unless otherwise noted, fixtures and trim for science casework shall be manufacturer's standard. Provide required openings in casework based on manufacturer's standard model numbers and coordinate with Divisions 22, 23 and 26.

1. Coordinate final mechanical and electrical connections.

1.3 DEFINITIONS

A. Exposed Portions of Millwork: Include surfaces visible when doors and drawers are closed. Bottoms of cases more than 4 feet above floor shall be considered as exposed. Visible members in open cases or behind glass doors also shall be considered as exposed portions.

B. Semi-Exposed Portions of Millwork: Includes those members behind opaque doors, such as shelves, divisions, interior faces of ends, case back, drawer sides, backs and bottoms, and back face of doors. Tops of cases 6 ft. – 6 in. or more above floor shall be considered semiexposed.

C. Concealed Portions of Millwork: Include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

1.4 SUBMITTALS

A. Manufacturer’s Product Data sheets shall be required for each item specified.

B. Shop Drawings: Furnish shop drawings giving details and sizes, including methods of attachment and anything pertinent to the installation work. Include full Specification requirements. Show locations for support in metal stud walls.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Furnish shop drawings in adequate time so that the equipment covered thereby can be fabricated and delivered in accordance with the scheduled completion.
3. Take field measurements, record on shop drawings.

C. Samples shall be specifically required for non-specified manufacturer's products submitted as a Substitution.

D. Samples: 3 color samples of finishes for the Architect's selection

E. Product certificates shall be required by manufacturers of all products not specifically named in this Guideline certifying that each product furnished meets this Guideline, the Project Specifications and the individual project requirements for the purpose intended. Certificates shall be submitted with Shop Drawings.

F. Provide maintenance instructions before request for final payment.

1.5 PROJECT CONDITIONS

A. Casework shall not be delivered to Project site until conditioned storage space is provided. The casework specified under this Section is prefinished, and precaution must be taken to protect it against damage during installation and until final acceptance.

1.6 FLORIDA ACCESSIBILITY CODE FOR BUILDING CONSTRUCTION

A. Casework shall conform with the Accessibility Requirements Manual from the Florida Department of Community Affairs, Florida Board of Building Codes and Standards.

1.7 QUALITY ASSURANCE

A. Contractor Qualifications: Employ only experienced Contractors (Installers) skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five (5) years.

B. Manufacturer Qualifications: Employ only manufacturers with at least five (5) years experience making the specified materials as a current catalog and regular production item.

C. Product Standards

1. Casework shall comply with SEFA 8, Laboratory Furniture-Casework, Shelving and Tables-Recommended Practices.
2. Water and Laboratory gas service fittings shall comply with SEFA 7, Laboratory and Hospital Fixtures--Recommended Practices.

D. Flammable Liquid Storage: Provide cabinets units for solvent or flammable liquid storage that are listed and labeled as complying with requirements of NFPA 30.

E. Source Limitations: To the extent possible, obtain laboratory casework, including countertops, sinks, service fittings, and accessories, through one source from a single manufacturer.

F. Preparation/Field Verification

1. Verify that Shop Drawings have been successfully submitted, reviewed and returned. Verify shop drawings dimension placement of mechanical and electrical rough-ins.
2. Verify field measurements have been taken that accurately reflect existing conditions.
3. Prior to installation, verify mechanical and electrical rough-ins are in proper positions specified.

1.8 WARRANTY

A. Project Warranty shall be as stated in Division 01 of the Specifications.

B. Manufacturer's Warranty

1. Casework manufacturer shall warrant all casework products against manufacturing defects in material and fabrication for a minimum period of three (3) years.
2. Casework manufacturer shall warrant against structural failure of the cabinet body for ten (10) years, lifetime preferred.
3. Accessories, such as sinks, fittings, apparatus and countertops shall be warranted against manufacturing defects in material and fabrication for a period of one (1) year.

C. Installer's Warranty: Installer shall warrant the entire installation against defects in material and workmanship for a period of three (3) years.

D. Unless otherwise stated in this Design Criteria, duration of all warranties shall begin on the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SAMPLE MATERIALS

A. Owner and the Architect will approve the successful bidder using the cabinetry sample, as the approval criteria. All items listed in this standard shall be exhibited on the cabinet sample to be selected.

B. The Sample may be an on-site mock-up and may be used as part of work upon Architect and Owners approval.

2.2 MANUFACTURER

A. Provide laboratory casework produced by Kewaunee Scientific Corp. or approved equal. Subject to meeting requirements the following manufacturers have prior approval:

1. Colledgedale.
2. Sheldon.
3. St. Charles.
4. Toscro, Inc.

5. Precision Panel.

2.3 MATERIALS

A. Plastic Laminate

1. Plastic Laminate: High pressure laminate conforming to NEMA LD3.
2. Manufacturers: Formica Corporation, Nevamar Corporation, Ralph Wilson Plastics Company, and Pionite Decorative Laminates

    a. Exposed horizontal surfaces: GP50 horizontal grade.
    b. Exposed, interior and exterior vertical surfaces: GP28 vertical grade.
    c. Backing sheet for concealed surfaces: Shall be 0.030 or 0.020 inches thick, conforming to NEMA standards for GP28 vertical grade or CL20 cabinet liner.
    d. Backing sheet for semi-exposed surfaces: GP28 vertical grade. Use to balance face laminate.
    e. Laminate Color: Interior and exterior colors to be chosen by Architect.

B. Melamine (for semi-exposed surfaces only.):

1. Melamine shall be saturated paper laminated to core. Weight of paper shall not be less than 80 grams.
2. Semi-exposed surfaces: Melamine shall conform to NEMA LD3-3.1-1991 for wear requirements for GP28 vertical grade.
3. Melamine-Faced Particleboard shall have decorative surface of thermally fused, melamine-impregnated web complying with ANSI/NEMA LD3 CL-20.

    a. Color of melamine: Selected by Architect.

C. Leading Edges:

1. Door and drawer fronts shall be edged with a 3mm thick high impact PVC extrusion with satin finish.
2. Horizontal and vertical front cabinet members shall be flat edged with a 3 mm thick high impact PVC extrusion with a satin finish.
3. Colors of PVC leading edges: Selected by Architect

D. Particleboard: (formaldehyde-free)

1. Cabinets and Countertops: Provide Premium Industrial Grade, conforming to the Commercial Standards CS-236-66 Type 1, Density B, Class 2, Property Requirements, (CS 1B2), also known as ANSI A208.1. Provide formaldehyde-free particleboard.

    a. Density, lb. per cu. ft. 47
    b. Modules or Rupture, lb. per sq. in. 2500
    c. Modulus of Elasticity, lb. per sq. in. 450000
    d. Internal Bond, lb. per sq. in. 100
    e. Thickness Swell (24 hr immerse) 4%
    f. Moisture Content % by weight 6.0
    g. Screw Holding Face 330 Edge 250
    h. Surface Strength lb. per sq. in. 275
    i. Hardness lb. 900

E. Locks:

1. Locks: Cylinder type, 5-pin tumbler mechanism, brass with chrome-plated finish. Each lock shall be provided with milled brass key and keying as specified in keyed different and master keyed or keyed alike. Each area shall be keyed alike. Locks shall be provided as shown on equipment drawings or described in cabinet description.
2. Each area or room shall be keyed alike unless individual student keying is indicated in the Millwork Schedule.
3. Locks shall be master keyed using the millwork manufacturer's keying system. (This is independent to the building master keying system.)
4. All science casework cabinets shall receive locks.

F. Accessories:

1. Service fixtures shall be laboratory grade, polished chrome finish with color coded identification.
2. Electrical receptacles shall be grounded and approved by National Board of Fire Underwriters.
3. Hinges: Notch for proper fit. 5-knuckle, 270-degree swing, institutional style, hospital tipped, steel, black
4. Pulls shall be manufacturer’s standard bent-wire type solid anodized aluminum or stainless steel, fastened from back with two screws. Provide 2 pulls for drawers more than 24 inches in width.
5. Base molding shall be of pliable black vinyl; 2 ½ inches high, capable of following contour of floor. The bottom cove shall guarantee a seal at floor line. Satin finish metal clips shall be used on exposed corners. Leg shoes shall be one piece and of same material and design as base molding.
6. Brackets: Gambos, Steel
7. Drawer Slides: Manufacturer's standard, epoxy coated metal, nylon rollers, 100 pounds dynamic load (or) European style, bottom mounted, captive profile, epoxy finished, nylon rollers, and 100 pounds dynamic loading with positive in-stop and out-stop. Comply with BHMA A156.9, Type B05091.
8. Adjustable Shelf supports: Recessed pilaster metal standards with metal pilaster supports. (KV 255AL pilaster with KV 256ZC pilaster support). Adjustable shelf supports shall provide for 25-pounds/SF capacity.

2.4 CONSTRUCTION

A. All fabrication will be monitored and approved by an AWI Quality Certification Program representative.

B. Laboratory Casework shall be manufactured in a climate-controlled environment, stored after fabrication in a climate controlled (temperature and humidity) storage area and shipped to the job site in an enclosed container (semi-tractor trailer).

C. Cabinet Bases: Manufacturer's standard 4-inch-high base construction of water repellent treated, ¾ inch plywood. Provide additional center support for cabinets over 24 inches wide.

D. Cabinet Boxes:

1. Sides, bottom, and top: Constructed of glued and spline doweled ¾ inch particleboard, providing balanced construction, surfaced with cabinet liner CL20 for semi-exposed and vertical grade laminate for exposed locations.

2. Wall cabinet bottoms and tops: Constructed of glued and spline doweled one inch thick particleboard, providing balanced construction surfaced with vertical grade laminate for exposed locations and cabinet liner CL20 for semi-exposed locations.
3. Back panel: Constructed of minimum 3/8 inch particleboard or ¼ inch prefinished tempered hard board, surfaced with melamine for semi-exposed and vertical grade laminate for exposed locations, inset and glued into sides, bottom, and top.
4. Exposed backs: Constructed of ¾ inch particleboard, surfaced with vertical grade laminate of balanced construction for semi-exposed locations, glued and spline doweled, and mechanically attached if required. Intermediate support rail: Minimum ¾ inch particleboard, surfaced with vertical grade laminate of balanced construction, glued and doweled into cabinet sides.

E. Fixed and Adjustable Shelves and Dividers:

1. One inch particleboard shelves. Provide for 25-pounds per square foot capacity.
2. Exposed Locations: Vertical grade plastic laminate both sides. Color to match cabinet exterior plastic laminate or as selected by Architect.
3. Semi-exposed locations: Vertical grade high pressure plastic laminate. Melamine surfaced shelves are not allowed.
4. Front and back leading edges shall be edged with flat 3mm thick high impact PVC edging to match shelf color.
5. Adjustable dividers: ¼ inch minimum thickness, prefinished tempered hardboard or plywood, smooth both faces, retained by molded plastic support clip.
6. Fixed dividers: Constructed of ¾ inch particleboard, surfaced with vertical grade laminate or melamine; providing balanced construction; glued and spline doweled. PVC edged to match laminate or adjacent PVC edging.

F. Cabinet Doors:

1. Hinged Doors:

    a. ¾ inch particleboard.
    b. High pressure plastic vertical grade laminate exterior and interior.
    c. Doors 48 inches and less in length shall have 2 hinges per door; doors over 48 inches in length shall have 3 hinges per door.
    d. Corners: Square with radiused edges, 3 mm PVC edging.
    e. Doors to be flush overlay design.

G. Drawers:

1. Manufacturers standard construction of minimum components listed below; or high density fiber board; glued and doweled or dovetail jointed; surfaced with vertical grade laminate or melamine of balanced construction. Bottoms constructed of minimum ¼ inch tempered hardboard, surfaced to match drawer sides, inset and glued to four sides.
2. Drawer Bodies: ½ inch construction.
3. Drawer Face

    a. Constructed of minimum ¾ inch particleboard, surfaced with high pressure vertical grade laminate exterior and interior, screw attached to the drawer box.

        1) Corners: To match doors.
        2) Edging: To match doors.
        3) Plastic Laminate: To match doors.

4. File Drawers: Constructed in accordance with a) and b) above. File drawers shall have front-to-back and side-to-side hanger file capability with hanger channel for letter size files integral with file drawer sides. 3/16 inch by ½ inch removable steel channel to span side-to-side for legal size hanging files.
5. Drawers to be flush overlay design.

H. Science Casework Countertops:

1. Tops shall be 1” thick, one-piece construction factory molded, black modified epoxy-resin, chemical-resistant formulation with smooth, non-specular finish.

   a. Edge: Eased.

2. Sinks shall be one-piece, epoxy-resin, chemical-resistant, “drop-in” style construction furnished with poly-propylene sink outlets. Sink inside corners and bottoms shall be coved for easy cleaning.
3. Backsplash shall be ¾” thick and match counter tops.

2.5 CASEWORK COUNTERTOPS

A. Molded Epoxy Resin (Kemresin) Tops

1. Molded from a modified epoxy resin that has been especially compounded and cured to provide the optimum physical and chemical resistance properties required of a heavy-duty laboratory tabletop.
2. Tops and Curbs: Provide a uniform mixture throughout thickness. Tops and curbs shall be non-glaring and black in color. Provide 1" thick tabletops, with drip grooves provided on the underside at all exposed edges. Provide all exposed edges except as indicated below, rounded to a 1/4" radius at front top edge and at vertical corners. Integrally molded 4" high curbs at the backs and ends of standard 31" and 24" wide tops shall be 3/4" thick, and the juncture between top and curb coved to a 3/4" radius. Provide curbs on special width tops and around special cutouts of the same thickness as the tops, bonded to the surfaces of the top to form a square joint.
3. Sink Cutouts: Smooth and uniform without saw marks and the top edge with a uniform radius of approximately 1/8". Finish the bottom edge of the sink opening smooth with the edge broken to prevent sharpness. Radius corners of the sink cutouts not less than 3/4".
4. Provide, where indicated, indented table tops 1 1/4" thick at outer edge, indented 1/4" to provide a raised rim 5/8" wide around all exposed edges. Round the front top edge of the raised rim and exposed vertical corners of the top to a 1/8" radius. Cove the juncture between the raised rim and the top surface to a 1/4" radius.

B. Impregnated welded fiber top (Kem Shield).

1. Temperede pressed wood finished with a highly resistant, baked on resinous coat.
2. Tops and Curbs: Generally, follow paragraph 2.6, A2 above.
3. Sink Cutouts: Generally, follow paragraph 2.6, A3 above.

2.6 ADA SAFETY CABINET

A. Basis of Design Product and Manufacturer; Kewaunee Scientific Corporation, model G85 ADA Safety Cabinet

1. Size: 90” high x 31-5/8” deep x 36” long.

B. Cabinet Assembly G85WC902236-00.

1. Cabinet: 90" H x 211/4" D x 36" L with two fixed shelves and apron.

C. Work Top - Kemresin G85WT012236R.

1. Cabinet: 1" T x 285/8" D x 341/2" L with two fixed shelves and apron.

D. Fixture Package G85FP.

1. Eyewash: Deck Mounted Stainless Steel Bowl with four Gentle Spray Outlet Heads and plunger operated ball valve.
2. Shower: 10" Dia. ABS Plastic Shower Head with 1" I.P.S. Stay-Open Ball Valve with 591/2" long Pull Rod.

2.7 TEACHER DEMO STATION

A. Basis of Design Product and Manufacturer; Kewaunee Scientific Corporation, Instructors and Demonstration Benches.

1. Sizes: 30” x 60” and 30” x 96”.
2. Refer to drawings for sink locations.
3. Cabinet Assembly.

a. ADA Height.
b. (1) G71W362818 Four Drawer Cabinet.
c. ADA height bench uses ADA height cabinets.

4. Work Top: Kemresin 1" thick x length indicated.

a. 1" I.P.S. Sink Outlet.
b. Fixture Package.
c. Electric Fixtures: (1) S656-1_ 120 VAC GFCI Duplex Receptacle.
d. Fittings: Cold Water w/VB Gooseneck.
e. Single Outlet Service Fitting.
f. (2) Rod Socket.
g. Upright Rod Assembly.

2.8 SINKS AND DRAIN TROUGHS MOLDED EPOXY RESIN

A. Provide sinks of an especially modified epoxy resin, carefully compounded with selected materials to provide maximum physical and chemical properties. Provide non-glaring sinks, black in color with all inside corners coved and the bottom pitched to the drain outlet. Sinks shall possess a high resistance to mechanical and thermal shock.

2.9 MECHANICAL SERVICE FITTINGS

A. Laboratory Service Fittings: Provide laboratory grade service fittings, with water faucets and valve bodies of cast red brass alloy or bronze forgings, with a minimum content of 85%. Provide chromium plated fittings unless specified otherwise. Use Chicago Faucet Co.

B. Combination Fixture Water and Gas (Natural): Unicast Vandalguard fitting. Water fitting shall have the main body cast in one piece of 5A-ASTM-30 brass. Tubing shall not be a part of its structure. Body shall be carefully machined using standard valve seat, composition washer, upgrading screw threads and stem for hot or cold water. Operating handle shall be of delrin plastic fitting with cold or hot water index. Entire fixture shall have beige color, baked plastic coating resistant tocleaning abrasions and reagent fumes. Provide a removable anti-splash outlet aerator. Fixture shall be fitted with a neoprene gasket and service from below with tail piece through the mounting service secured with locknuts.

C. Ground Key Valve Hose Cocks: Provide ground key type valves with forged body and 10 serration hose end. Provide forged brass handle plug, long, tapered type with screw-on colored service index button. Individually ground, lap and seal valve.

D. Gooseneck Type Outlets: Provide gooseneck outlets with a separate brazed coupling to provide a full thread attachment of antisplash, serrated tip or filter pump fittings.

E. Service Indexes: Provide fittings identified with service indexes in the following color coding:

Service	Color	Lettering ID
Hot Water	Red	HW
Cold Water	Dark Green	CW
Gas Dark	Dark Blue	GAS
Air	Orange	AIR
Vacuum	Yellow	VAC
Distilled	Water White	DW
Steam	Black	STM
Nitrogen	Brown	N
Oxygen	Light Green	02
Hydrogen	Pink	H
Special Gasses	Light Blue	(As req'd)

F. Electrical Fittings: Provide electrical fittings with 20 Amp., 125 Volt AC, 3-wire isolated grounded receptacles, unless other-wise specified. Provide aluminum pedestal and line-type boxes metallic finish with stainless steel flush plates and plated steel receptacle boxes. All electrical or conduit fittings called to be furnished under these specifications shall meet the requirements of the National Electrical Code. Service fixtures are indicated by type on the drawings. Provide stainless steel, Type 302, satin finish black cover plates. Provide 1/4" high letters for cover plate identification for receptacles, switches, terminal posts and other locations indicated.

G. Sink Outlets: Unless otherwise specified, provide molded epoxy resin sink outlets for other than stainless steel sinks, with gasket and lock nut with 1 1/2" I.P.S. male straight thread outlet. Do not furnish overflows for sink outlets unless specifically called for.

H. Furnish No. 0469-00 polypropylene trap and sink outlet assembly.

I. Crumb Cup Stainers: Provide stainless steel or chromium plated brass crumb cup stainers as specified for stainless steel sinks, complete with gasket, lock nut and 4" long unthreaded tailpiece outlet in 1 1/2" size.

J. Vacuum Breakers: Provide "Nidel" or "Watts" vacuum breakers where required unless otherwise specified or identified to be an integral part of the water fixture assembly.

K. Aerator Outlets: Furnish aerator type outlets for all gooseneck water faucets not furnished with serrated hose connectors.

PART 3 - EXECUTION

3.1 CASEWORK INSTALLATION

A. Install plumb, level, true and straight with no distortions. Shim as required, using concealed shims. Where laboratory furniture abutts other finished work, scribe and apply filler strips for accurate fit with fasteners concealed where practicable.

B. Base Cabinets: Set cabinets straight, plumb, and level. Adjust sub-tops within 1/16" of a single plane. Fasten each individual cabinet to floor at toe space, with fasteners spaced 24" o.c. Bolt continuous cabinets together. Provide inside sub-base pressure treated 2x4 blocks minimum 12" long secured to floor with no less than two "Tapcon" screw anchors fully into solid substrate. After leveling, secure through base into these blocks. Secure individual cabinets with not less than 2 fasteners into floor, where they do not adjoin other cabinets. Where required, assemble units into one integral unit with joints flush, tight and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16".

C. Wall Cabinets: Securely fasten to solid supporting material, not plaster, lath, or wallboard. Anchor, adjust and align wall cabinets as specified for base cabinets. Reinforcement of stud walls to support wall-mounted cabinets will be done during wall erection by trade involved, but responsibility for accurate location and sizing of reinforcement is part of this work.

D. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.2 INSTALLATION OF TOPS

A. Field Jointing: Where practicable, make in same manner as factory jointing using dowels, splines, adhesives, and fasteners recommended by manufacturer. Locate field joints as shown on accepted shop drawings, factory prepared so there is no job site processing of top and edge surfaces.

B. Fastenings: Use concealed clamping devices for field joints, located within 6" of front, at back edges and at intervals not exceeding 24". Tighten in accordance with manufacturer's instructions to exert a constant, heavy clamping pressure at joints. Except for natural stone, composition stone and epoxy tops, secure tops to cabinets with "Z"-type fasteners or equivalent, using 2 or more fasteners at each front, end, and back.

C. Workmanship: Abut top and edge surfaces in one true plane, with internal supports placed to prevent any deflection. Provide flush hairline joints in top units using camping devices. At stone-type material joints, use manufacturer's recommended adhesives and holding devices to provide joint widths not more than 1/16" wide at any location, completely filled and flush with abutting edges. Where necessary to penetrate tops with fasteners, countersink heads approximately 1/8" and plug hole flush with material equal in chemical resistance, color, hardness, and texture to top surface. After installation, carefully dress joints smooth, remove

any surface scratches, clean and polish entire surface. Provide holes and cutouts as required for mechanical and electrical service fixtures. Provide scribe mouldings for closures at junctures of top, curb and splash with walls as recommended by manufacturer for materials involved. Use chemical resistant, permanently elastic sealing compound where recommended by manufacturer.

D. Use acid resistant laminated plastic where practical. Kem Shield tops are to be provided at all counters adjacent to walls in all Science Department Classrooms, Labs and Material Storage. Kem Resin tops on all Student Research units and demonstration tables.

3.3 INSTALLATION OF SINKS

A. Underside Installation: Use manufacturer's recommended adjustable support system for table-type and cabinet-type installations. Set top edge of sink unit firmly pressed to counter top, set in manufacturer's recommended chemical resistant sealing compound to produce a tight and fully leakproof joint. Adjust sink and securely support to prevent movement.

3.4 INSTALLATION OF ACCESSORIES

A. Install in a precise manner in accordance with manufacturer's directions. Turn screws to a flat seat; do not drive. Adjust moving parts to operate freely without excessive bind.

B. Unless otherwise indicated all cabinets are to receive Division 9 full 4" high vinyl base, without the necessity to trim.

3.5 CLEANING AND PROTECTION

A. Repair or remove and replace defective work as directed upon completion of installation.

B. Clean shop-finished surfaces, touch-up as required, and remove or refinish damaged or soiled areas, as acceptable to ARCHITECT.

C. Protection: Advise Contractor of procedures and precautions for protection of materials and installed laboratory furniture from damage by work of other trades.

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SECTION 12 35 80
MUSIC CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide labor, materials, and equipment necessary for the complete installation of music casework shown on the Drawings, specified herein, or listed in the schedule following this Section.

B. This Work includes special and modified stock design pre-assembled units for installation as movable, fixed, or built-in, as noted on the Drawings, or listed in the schedule.

C. The catalog numbers of the manufacturer listed on the Music Casework Schedule are intended to include a complete and total item, as the catalog number is specified in the manufacturer's current catalog. Although the description in the schedule is brief, the item shall be provided complete with hardware, accessories, features, and components for a complete installation in every respect.

D. The use of dimensions and specific requirements set forth in the Contract Documents are not intended to preclude the use of other acceptable manufacturer's product or procedures which may be equivalent, but are given for purpose of establishing standard of design and quality for materials, construction, and workmanship.

1.3 SUBMITTALS

A. Furnish shop drawings giving details and sizes, including methods of attachment. Show field measurements. Include specification requirements and color samples of finishes for the Architect's selection. Indicate locations of reinforcement and blocking required in walls for attachment of music casework.

B. Submit guarantee as specified herein.

C. Provide maintenance instructions prior to request for final payment.

D. Samples of colors shall be submitted upon award of contract for selection and coordination with other suppliers. ARCHITECT may request and retain samples and catalog cuts as required for accessory and special items.

1.4 JOB CONDITIONS

A. Do not deliver casework to project site until controlled conditioned space is provided. Take field measurements to insure proper fit of casework items.

B. Take field measurements to insure proper fit of casework items.

1.5 QUALITY CONTROL

A. Defective workmanship or damaged components shall be corrected, repaired, or replaced, as requested by the Architect, without further cost to the Owner.

B. Manufacturer Qualifications: At least 5 years experience in the manufacturer and installation of the type of cabinets specified.

C. Installer Qualifications: At least 3 years experience in the installation of the type of cabinets specified.

1.6 GUARANTEE

A. The entire installation shall be guaranteed for a period of 3 years from the Date of Substantial Completion against defects in material and workmanship in accordance with the terms of the Contract. The guarantee shall cover repair or replacement, without cost to the Owner, of items that become defective within the 3-year period. Damage to the equipment caused by improper operation or misuse is not covered by this guarantee.

1.7 DESIGN REQUIREMENTS

A. Design system of cabinets that will be chip and abrasion resistant under normal usage and will protect instruments and cases from damage under normal use.

B. Design shelving to withstand continuous use without surface or front edge breakdown.

C. Doors to support a minimum vertical load of 200 pound applied at outer edge.

D. Hanger rods to support a minimum vertical load of 200 pound applied anywhere.

E. Provide individual modular compartment lockers for each instrument, each compartment with its own separately lockable, open wire grill door.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: Wenger Corporation.

1. Cabinet Sizes and Configuration: As indicated on the drawings.

B. Products of the following manufacturers are also acceptable for the casework and equipment specified.

1. LSI Corporation of America, Inc.
2. Sheldon Laboratory Systems, a Division of General Equipment Manufacturers, Inc.
3. Stevens Industries, Inc.

2.2 CABINET WALL PANELS

A. Cabinet wall panels shall be constructed of thermoset composite wood panels, .750 inches thick in conformance with the American Laminators Association performance standard, ALA 1985. Color to be sand.

2.3 CABINET SHELVING

A. Cabinet shelving shall be designed in such a way to eliminate sharp edges which can damage instrument cases.

B. Shelf materials shall be designed in such a way to withstand continuous use without surface and front edge breakdown.

C. All shelving for cabinets 27 inches wide or narrower shall be constructed of a one-piece high molecular blow-molded polyethylene material incorporating a 1.375 inch radius leading edge.

D. Shelves are to be mounted to cabinet walls with self-locking steel supports.

E. All shelving for cabinets over 27 inches wide shall be constructed of .75 inch thick composite board, 45 lb. density with steel supports. Leading edge and top surface shall be of a radiused thermoplastic .030 high pressure laminate.

2.4 PLASTIC EDGING

A. Exposed cabinet panel edges shall be bonded with .078 in beveled PVC edge banding.

2.5 VENTILATION

A. Cabinets will provide for ventilation by means of:

1. Air entry opening in base of cabinet.
2. Front and rear air space for each shelf.
3. Air exit opening in top of cabinet.
4. Air gap around solid compartment doors.

2.6 JOINERY HARDWARE

A. Basic cabinet joinery hardware shall be two inch, 1/4-20 panel connectors with 15mm head diameter, and steel threaded inserts.

2.7 DOORS

A. Grille Doors: Doors shall be grille type, 5/16 inch perimeter/reinforcing, and 3/16 inch interior vertical wire. Door and welded hinges shall have epoxy powder coat finish. Color as selected by the Architect.

2.8 HARDWARE

A. Hinges: Compartment doors shall have two .094 case hardened spring steel barrel hinges with .25 inch diameter, non-removable pins. Each hinge shall be fastened to the cabinet wall panel using two low profile capscrew assemblies bolted through entire thickness of wall panels. Full length cabinet doors shall have continuous hinges.

B. Door Latch: Door latch shall be a dead-bolt slide mechanism constructed of formed 14 gauge steel. Steel strike plate for dead- bolt slide shall be fastened to cabinet wall. Latch shall be designed to accept standard padlocks by user.

1. A clear plastic protector shall be supplied with latch hardware to house
2. compartment identification system.

C. Cabinet Levelers Each cabinet shall be equipped with four adjustable levelers threaded through four steel corner brackets. Thread diameter shall be not less than 3/8 inch.

2.9 WORKMANSHIP - GENERAL

A. Machine parts for accurate fit and assemble with appropriate fastenings and adhesives to result in square, level, and plumb units.

B. Verify dimensions of other trades to be built into casework.

C. Provide removable or false backs for access or concealment of heating or plumbing utilities.

D. There shall be a minimum scribe with cabinets at end walls unless shown otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install per shop drawings and manufacturer’s installation instructions.

B. Make use of filler sections and scribe panels to fit cabinet work into specific dimensions.

C. Provide all items and accessories as required for a complete installation in every respect.

3.2 ADJUSTMENT

A. Adjust door catches, drawer slides, and other moving parts after installation to provide proper operation. Doors shall align with locks.

B. End cabinets placed against corners where they tee into other cabinets or obstacles shall be provided with chain or bracket stops on the inside of the doors to prevent the door or door handles from hitting the obstruction.

C. All music locker doors, door catches, drawer slides, and other moving parts shall be fully functional and lockable at Substantial Completion.

3.3 CLEANING

A. Exposed surfaces, edges, and cabinet interiors shall be cleaned, and construction and installation marks removed prior to acceptance by Owner.

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SECTION 12 36 16
METAL COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Stainless-steel countertops.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, sections, details, and attachments to other work.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction to receive metal countertops by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

B. Sealant for Countertops: Manufacturer's standard sealant of characteristics indicated below that complies with applicable requirements in Section 07 92 00 "Joint Sealants."

1. Mildew-Resistant Joint Sealant: Sanitary Silicone, single component, nonsag, neutral curing, silicone.
2. Color: Clear.

2.2 STAINLESS-STEEL COUNTERTOPS

A. Countertops: Fabricate from 16 gauge, stainless-steel sheet. Provide smooth, clean exposed tops and edges in uniform plane, free of defects.

1. Joints: Fabricate countertops without field-made joints.
2. Weld shop-made joints.
3. Sound deaden the undersurface with heavy-build mastic coating.

2.3 STAINLESS-STEEL FINISH

A. Grind and polish surfaces to produce uniform, directional satin finish matching No. 4 finish, with no evidence of welds and free of cross scratches. Run grain with long dimension of each piece. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of metal countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install metal countertops level, plumb, and true; shim as required, using concealed shims.

B. Field Jointing: Where possible, make field jointing in the same manner as shop jointing; use fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

C. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.

D. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant.

3.3 CLEANING AND PROTECTION

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over the countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c.

END OF SECTION 12 36 16

SECTION 12 36 61.16
SOLID SURFACE COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-surface-material countertops and backsplashes.

1.3 ACTION SUBMITTALS

A. Product Data: For materials indicated.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:

1. Countertop materials, 6 inchessquare.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build mockup of typical countertop as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Basis-of-Design Product: Provide product indicated on the Finish Schedule, or a comparable product by one of the following:

a. E. I. du Pont de Nemours and Company; Corian
b. Formica Corporation.
c. Wilsonart LLC.

2. Colors and Patterns: As selected by Architect from Manufacturers full range.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration: As Indicated.

C. Countertops: Thickness, as indicated.

D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

E. Joints: Fabricate countertops in sections for joining in field.

1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.

F. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesives: Adhesives shall not contain urea formaldehyde.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

H. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 12 36 61.16

SECTION 12 36 61.19
QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Quartz agglomerate countertops.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build mockup of typical countertop as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.

1. Basis of Design Product and Manufacturer; As Indicated on the Finish Schedule, or comparable product by one of the following:

a. Cambria.
b. E. I. du Pont de Nemours and Company.
c. Wilsonart LLC.

2. Colors and Patterns: As selected by Architect from Manufacturers full range.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration: As Indicated.

C. Countertops: Thickness, as indicated.

D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

E. Joints: Fabricate countertops in sections for joining in field.

1. Joint Locations: Not within 18 inches of a sink and not where a countertop section less than 36 inches long would result, unless unavoidable.
2. Joint Type: Bonded, 1/32 inch or less in width.
3. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

F. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
b. Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch into fixture opening.
c. Provide 3/4-inch full bullnose edges projecting 3/8 inch into fixture opening.

2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

H. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION 12 36 61.19

SECTION 12 61 00
FIXED AUDITORIUM SEATING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes fixed, chair-type seating with the following:

1. Standard mounting.
2. Molded-plastic chairs with upholstered inserts.

1.3 COORDINATION

A. Coordinate layout and installation of electrical wiring and devices with seating layout to ensure that floor junction boxes for electrical devices are accurately located to allow connection without exposed conduit.

B. Coordinate layout and installation of diffuser pedestals with HVAC work and with properties of diffuser pedestals to ensure alignment, proper air diffusion, and correct seat locations.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of components, and finishes for fixed audience seating.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Seating Layout: Show seating layout, aisle widths, aisle-end alignment or stepping, row-lettering and chair-numbering scheme, chair widths, and chair spacing in each row.

C. Samples for Initial Selection: For each type of exposed color, finish, texture, and pattern indicated.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Chair Unit: Full-size unit of each type and combination of finishes.
2. Molded Plastic: Manufacturer's standard-size unit, not less than 3 inches square.
3. Baked-on Coating Finishes: Manufacturer's standard-size unit, not less than 3 inches square.
4. Aluminum Finishes: Manufacturer's standard-size unit, not less than 3 inches square.
5. Upholstery Fabric: Full width by 36-inch- long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.
6. Row-Letter and Chair-Number Plates: Full-size units with letters and numbers marked.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fixed audience seating.

B. Material Certificates: For each type of flame-retardant treatment of upholstery fabric.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fixed audience seating to include in operation and maintenance manuals.

1. Maintenance of self-rising seat mechanisms, folding armrests, and other operating components.
2. Adjustment of self-rising seat mechanisms to align seats.
3. Methods for maintaining upholstery fabric.
4. Precautions for cleaning materials and methods that could be detrimental to seating finishes and performance.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Chair Seats and Backs: 1% percent of quantity installed for each type and size of chair seat and back.
2. Fabric: 1% percent on the bolt of quantity installed for each type.
3. Armrests: 1% percent of quantity installed for each type of armrest.
4. Chair Seat Hinges: 1% percent of quantity installed.
5. Donor Plates: 1%.

1.9 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups of two typical seats or a typical two-seat unit, including finishes and accessories:
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fixed audience seating that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including standards, beams, and pedestals.
b. Faulty operation of self-rising seat mechanism.
c. Wear and deterioration of fabric and stitching beyond normal use.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Periods: As follows, from date of Substantial Completion.

a. Structural: Lifetime.
b. Operating Mechanisms: Lifetime.
c. Plastic, and Paint Components: Five years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of seating required, including accessories and mounting components, from single source from single manufacturer.

1. Upholstery Fabric: Obtain fabric of a single dye lot for each color and pattern of fabric required.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics of Upholstered Chairs:

1. Fabric and Padding:

a. Fabric: Class 1 according to DOC CS 191 or 16 CFR 1610, tested according to California Technical Bulletin 117-2000.

b. Padding: Comply with California Technical Bulletin 117-2000.

2. Upholstery Assembly: Assembly shall comply with component-testing requirements of California Technical Bulletin 117-2013.

B. Strength and Durability Performance: Chairs and components shall pass testing according to BIFMA X5.4.

2.3 FIXED AUDIENCE SEATING

A. Description: Assembly-space seating in permanent arrangement and fixed skids (ADA compliant seating) as indicated on Drawings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hussey Seating Company; Model Quattro Classic or a comparable product by one of the following:

a. Ducharme Seating International Inc.
b. Irwin Seating Company.
c. Davis Furniture Company.

B. Chair Mounting Standards: Floor attached of the following material:

1. Cast Aluminum: One-piece castings with integral mounting points and attachment anchoring points for seat pivots, backs, and armrests.

C. Fabric Upholstered Chairs:

1. Back:

a. Padding Thickness: 2 inches.
b. Outer Back Surface: Molded plastic, with concealed fasteners.
c. Top Corners: Rounded.
d. Upholstery Options: Waterfall.

2. Seat: Standard and as follows:

a. Top Padding Thickness: Minimum 3 inches at front and rear edges.
b. Seat Bottom: Molded-plastic shell.

D. Chair Width: As Indicated.

E. Back Height: 33 inches high from the floor.

F. Back Pitch: Fixed.

G. Chair Seat Hinges: Self-lubricating, with noiseless self-rising seat mechanism passing ASTM F 851, positive internal stops cushioned with rubber or neoprene, and requiring no maintenance.

1. Self-Rising Seat Mechanism: Spring actuated, three-quarter fold.

H. Armrests: Molded plastic with rounded edges and concealed mounting.

I. Accessible Seating:

1. Provide removable chairs for each wheelchair space unless otherwise indicated.

J. Row-Letter and Chair-Number Plates: Manufacturer's standard.

1. Material: Aluminum with black embossed characters.
2. Attachment: Manufacturer's standard method.

2.4 MATERIALS AND FINISHES

A. Molded Plastic: High-density polyethylene or polypropylene, blow or injection molded, with surface that is mar and dent resistant.

1. Color and Texture: Match Architect's sample.

B. Fabric: Manufacturer's 100% olefin yarn, 16 oz./ linear yard with 10 year warranty..

1. Color and Pattern: Match Architect's sample.

C. Upholstery Padding: Flexible, cellular, molded or slab polyurethane foam.

1. Pounding-Fatigue Performance: Grade AP (heavy-duty use) for seats and Grade BP (normal duty use) for backs; according to ASTM D 3453.

D. Metal Finish: Finish exposed metal parts with manufacturer's standard minimum 1.5-mil-thick, polyester baked-on powder coating.

1. Color: Match Architect's sample.

2.5 FABRICATION

A. Floor Attachments: Fabricate to conform to floor slope so that standards and pedestals are plumb and chairs are maintained at same angular relationship to vertical throughout Project.

B. Upholstery: Fabricate fabric-covered cushions with molded padding beneath fabric and with fabric covering free of welts, creases, stretch lines, and wrinkles. For each upholstered component, install pile and pattern run in a consistent direction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine floors, risers, and other adjacent work and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install seating in locations indicated and fasten to substrates according to manufacturer's written installation instructions.

1. Install seating with each chair capable of complying with performance requirements without failure or other conditions that might impair the chair's usefulness.
2. Install standards and pedestals plumb.
3. Install seating so moving components operate smoothly and quietly.

B. Install riser-mounted standards and attachments to maintain uniform chair heights above floor.

C. Where seating is indicated in curved rows, install seating at a constant radius unless otherwise indicated.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Inspect components, assemblies, and equipment, including connections, to verify proper, complete, and sturdy installation according to manufacturer's written instructions and product specifications.
2. Verify that self-rising seats return to uniform at-rest, raised position.

B. Fixed audience seating will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust chair backs so that they are at required angles and aligned with each other in uniform rows.

B. Adjust hardware and moving parts to function smoothly so they operate easily. Lubricate bearings and sliding parts as recommended in writing by manufacturer.

C. Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.

D. Replace damaged and malfunctioning components that cannot be acceptably repaired.

E. Replace upholstery fabric damaged during installation or work of other trades.

END OF SECTION 12 61 00

SECTION 12 66 00
TELESCOPING BLEACHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide labor, materials, and equipment necessary for complete installation of the telescoping bleachers as shown on the Drawings and specified herein.

1. Special applications included truncated front units, and removable front steps, as shown on the Drawings and Details.

B. Bleachers shall be one of the following types:

1. Molded plastic contoured seats on wood bleachers.

1.3 REFERENCES

A. Aluminum Association (AA):

1. ADM 1- Aluminum Design Manual

B. American Institute of Steel Construction (AISC):

1. AISC 360- Steel Construction Manual.

C. American Iron & Steel Institute (AISI):

1. AISI S100 – Design of Cold Formed Steel Structural Members.

D. American Society for Testing Materials (ASTM):

1. ASTM - Standard Specifications for Properties of Materials.

E. American Wood Council (AWC):

1. ANSI/AWC NDS (National Design Specification for Wood Construction).

F. American Welding Society (AWS):

1. AWS D1.1 Structural Welding Code – Steel
2. AWS D1.3 Structural Welding Code - Sheet Steel

G. U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

H. Florida Building Code (FBC): Current Edition.

I. International Code Council (ICC): Current Edition.

1. ICC 300: Standard for Bleachers, Folding and Telescopic Seating and Grandstands.

J. National Fire Protection Association (NFPA):

1. NFPA 101 Current Edition.
2. NFPA 5000 Current Edition: Building Construction and Safety Code
3. NFPA 70: National Electrical Code, Current Edition.

K. National Institute of Standards and Technology (NIST)

1. PS 1: Structural Plywood.

L. Southern Pine Inspection Bureau (SPIB):

1. SPIB: Standard Grading Rules for Southern Pine.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer, fabricate and install telescopic gym seating systems to the following structural loads without exceeding allowable design working stresses of materials involved, including anchors and connections. Apply each load to produce maximum stress in each respective component of each telescoping stand unit according to ICC 300 Current Edition.

B. Manufacturer's System Design Criteria:

1. Gymnasium seat assembly; Design to support and resist, in addition to its own weight, the following forces:

a. Live load of 120 lbs. per linear foot on seats and decking.
b. Uniformly distributed live load of not less than 100 psf of gross horizontal projection.
c. Parallel sway load of 24 lbs. per linear foot of row combined with (b.) above
d. Perpendicular sway load of 10 lbs. per linear foot of row combined with uniformly distributed live load above.
e. Parallel and Perpendicular sway loads are not applied concurrently.

C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Hand Railings, Posts and Supports: Engineered to withstand the following forces applied separately:

a. Concentrated load of 200 lbs. applied at any point and in any direction.
b. Uniform load of 50 lbs. per foot applied in any direction.

2. Guard Railings, Post and Supports: Engineered to withstand the following forces applied separately:

    a. Concentrated load of 200 lbs. applied at any point and in any direction along top rail.
    b. Uniform load of 50 lbs. per foot applied in any direction at top rail.
    c. Uniform load of 50 lbs. applied on an area equal to 1 ft^2 applied on all guardrail infill panels.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Factory certification by the manufacturer.

1. Project list: Ten projects of similar size, complexity and in service for at least five years.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Seating Layout: Provide telescoping stands to comply with ICC 300 Current Edition Standard for Bleachers, Folding and Telescopic Seating, and Grandstands, except where additional requirements are indicated or imposed by authorities having jurisdiction.

E. Engineer Qualifications: Engage professional licensed engineer experienced in providing engineering services of the kind indicated that have resulted in the successful installation of telescoping bleachers similar in material, design, fabrication, and extent to those types indicated for this project.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For telescoping stands in both stacked and extended positions. Show seat heights, row spacing and rise, aisle widths and locations, assembly dimensions, anchorage to supporting structure, material types and finishes.

1. Electrical: Indicate power supply requirements.
2. Graphics Layout Drawings: Indicate pattern of contrasting or matching seat colors.
3. Shop drawings shall be stamped, signed, sealed and certified by a Structural Engineer in the State of Florida.

C. Samples: For units with factory-applied finishes.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified manufacturer and installer.

B. Welding certificates.

C. Product Test Reports: Load test to all loads, observed by a qualified independent testing laboratory, and certified by a registered professional structural engineer verifying the integrity of the manufacturer's design.

D. Warranty: Manufacturers standard warranty documents.

E. Shop drawings shall be stamped, signed, sealed and certified by a Structural Engineer in the State of Florida.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For telescopic bleacher to include video operations manual.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver telescopic gym seats in manufacturers packaging clearly labeled with manufacturer name and content.

B. Handle seating equipment in a manner to prevent damage.

C. Deliver the telescoping stands at a scheduled time for installation that will not interfere with other trades operating in the building when at all possible.

1.10 PROJECT CONDITIONS

A. Field Measurements: Coordinate actual dimensions of construction affecting telescoping bleaches installation by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate construction progress to avoid delay of Work.

1.11 WARRANTY

A. Manufacturer's Warranty: Includes the repair or replacement of the defective product; or defective component thereof, with a comparable product; or component thereof, or a refund of the purchase price prorated over the warranty period.

1. Includes: Labor, materials, and freight for replacement or repairs.
2. Structural Component parts of Understructure Warranty Period: 10 years from Date of Acceptance
3. Decking systems, seating collections, electrical, portable and integral dolly systems, end closure curtains, surface material finishes Warranty Period 5 years from Date of Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Product and Manufacturer; MAXAM, Hussey Seating Company, other acceptable manufacture which may be incorporated into the work are but not limited to the following:

1. Folding Bleacher Company
2. Irwin Telescoping Seating Co.
3. Interkal, Inc.
4. Kodiak Bleachers, Inc.

B. Wood:

1. Lumber: NIST PS 20, southern pine complying with SPIB's "Standard Grading Rules for Southern Pine Lumber" for B&B Finish (B and better) grade-of-finish requirements.
2. Plywood: NIST PS 1, APA-grade trademarked, A-C grade.

C. Steel:

1. Structural-Steel Shapes, Plates, and Bars: ASTM A36.
2. Galvanized-Steel Sheet: ASTM A653, coating designation G60.
3. Uncoated Steel Strip; Non-Structural Components: ASTM A1011, Commercial Quality, Type B, Hot-Rolled Strip.
4. Uncoated Steel Strip; Structural Components: ASTM A1011 Grade 33, Grade 36, Grade 40, Grade 45, or Grade 50, Structural Quality, Hot-Rolled.
5. Galvanized Steel Strip: ASTM A653 Grade 40, structural quality, coating designation G60.
6. Tubing: ASTM A500, cold formed; Grade B.

D. Polyethylene Plastic: High-density polyethylene; injection molded, color-pigmented, textured, impact-resistant, and dimensionally stable.

2.2 TELESCOPING STANDS

A. Wall-Attached Telescoping Stands**:** Forward-folding system with the rear of the understructure permanently attached to the floor and to the rear wall. Rear wall provides structural support and must support loads imposed by the bleacher.

2.3 DIMENSIONAL AND OPERATIONAL CRITERIA

A. Dimensions:

1. Bank Length: As indicated.
2. Aisle Width: As indicated.
3. Number of Tiers: As indicated.
4. Row Spacing: As indicated.
5. Row Rise: As indicated.
6. Open Dimension: As indicated.
7. Closed Dimension: As indicated.

8. Overall Unit Height: As indicated.Operation: Integral Power.

1. Integral Power.

2. Operable equipment in the gym shall have handheld remote for maintenance.
3. When operable equipment in the gym has a wall switch, the switch shall be a double throw switch instead of a key. The wall switch shall be placed within a lock box.

    a. Limit Switches: Automatically stop integral power system when telescoping stands reach fully opened or closed positions.
    b. Motion Monitor: Flashing light with self-contained warning horn, rated at 85 dB, activates when stands are in motion.

2.4 SEATING

A. Polymer Seat System: Courtside Collection XC12.

1. Material: Gas assist injection-molded, 100 percent recyclable HDPE, high density polyethylene.
2. Module Size: As indicated.
3. Module Load: Tested to 600 lbs.
4. Seat height range from deck to top of seat: As indicated.
5. Integrally molded end caps at aisle end locations.
6. Integrally molded recess pockets to accept seat number and row letters.
7. Integrally molded rear closure panel at back of seat to allow for "continuous clean sweep" of debris at deck level and minimized visibility of structural ribbing.
8. Color: Custom color as selected by Architect from Manufacturers full range.
9. Seat Numbers: 1-3/4 inch by 1-1/4 inch oval Lexan plate.

    a. Color: Black number over grey background.

10. Row Identification: 1-3/4 inch by 1-1/4 inch oval Lexan plate.

    a. Color: Black letter over gray background.

B. ADA Accessible Seating:

1. Locate first tier modular units to provide wheelchair-accessible seating at locations indicated on Drawings.

    a. Provide first row modular recoverable seating units that can be closed to accommodate persons requiring ADA spaces (or any other temporary space needs) or opened for standard usage. Each Flex-Row unit shall have a handle for easy operation.

        1) Provide a black full-surround steel skirting with no more than ¾” floor clearance for safety and improved aesthetics.
        2) Provide a black injection molded end cap for the nose beam for safety and improved aesthetics.
        3) Provide a mechanical positive lock when the Flex-Row system is in both the open and closed position. Handle shall unlock the modular recoverable seating unit for operation.
        4) Flex-Row can be utilized with the full system in the open or closed position.

5) Flex-Row modular units are designed to achieve multi-use front row seating to accommodate team seating, ADA requirements and facility specific requirements. Flex-Row units are available in modular units from 2 to 7 seats wide as well as full section widths.
6) Flex-Row Removable belt barrier.
7) Available With or signage to mark the location of each recoverable Flex-Row module to assist with seating identification.

b. Permanent ADA Units: first-tier fixed end-section units with a full width front closure panel, extending from underside of second tier to within 1-1/2 inches of finished floor.

2.5 RAILS, PANELS AND STEPS

A. End Rails:

1. Self-storing

a. Provide steel self-storing starting no higher than tier 2 42 inches high above seat, end rail with tubular supports and intermediate members designed with 4 inch sphere passage requirements.

2. Material and Finish: As selected by Architect from manufacturers full range.
3. Color: As selected by Architect from manufacturers full range.

B. Center Aisle Rails:

1. Provide single pedestal mount handrails 34 inches high with terminating mid rail. Permanently attached handrail shall rotate in a permanently mounted socket for rail storage. Rail shall automatically rotate, lock in the use position, unlock and rotate back to the stowed position as the gym seats open and close. Ends of the handrail shall return to the post, and not extend away from it. Rails having openings to avoid interference with closed decks are not acceptable
2. Material and Finish: As selected by Architect from manufacturers full range.
3. Color: As selected by Architect from manufacturers full range.

C. Fixed Front Closure Panels:

1. Material: Polydeck attached to a powder coated steel framework.
2. Color: As selected by Architect from manufacturers full range.

D. End Closure Panels: For closed stack position at each exposed bank end.

1. Material: Polydeck attached to a powder coated steel framework.
2. Color: As selected by Architect from manufacturers full range.

E. Steps

1. Removeable Front Aisle Steps: At each vertical aisle location front aisle step. Front steps shall engage with front row to prevent accidental separation or movement. Provide four non-skid rubber feet each 1 inch in diameter. Full radius end caps on all four edges.
2. Intermediate Aisle Steps: Fully enclosed, at each vertical aisle. Full radius end caps on all four edges. Adhesive-backed abrasive non-slip tread surface.

2.6 COMPONENTS

A. Decking

1. Plywood

a. 5/8 inch thick AC grade tongue and groove Southern Yellow Pine with clear urethane, high gloss finish.

2. Polydeck

a. 5/8 inch thick BC grade polyethylene-top-coated tongue and groove Douglas Fir plywood.
b. Polyethylene overlay bonded to substrate, 0.03 inch thickness.

B. Understructure:

1. Finish: Hot dipped galvanized (High humidity finish).
2. Hardware finish: Corrosion resistant, Hot dipped galvanized (high humidity finish).
3. Posi-locks and other surfaces: Electroless-nickel plated, Hot dipped galvanized (High Humidity finish).
4. Nose beam and Rear Riser beam: Nose beam shall be continuously roll-formed closed tubular shape of ASTM A653 grade 40. Riser beam shall be continuously roll-formed of ASTM A653 grade 40. Nose and Riser beam shall be designed with no steel edges exposed to spectator after product assembly. Nose beam and riser beams are through-bolted fore/aft to deck stabilizers and frame cantilevers to create the deck structure.
5. Frame: The frames are welded assemblies (one left hand, one right hand per tier) comprised of the following components:

a. Lower Track subassembly: ASTM A1011 Grade 50: Continuous Positive Interglide System (casterhorn) interlocks each adjacent frame casterhorn using an integral, continuous, anti-drift feature and captive interlock with adjustable row spacing at front to prevent separation and misalignment.
b. Lower Track Wheels: 3 per frame Not less than 5 inches diameter by 1-1/4 inches with non-marring soft rubber face to protect wood and synthetic floor surfaces, with molded-in sintered iron oil-impregnated bushings to fit 3/8 inch diameter axles secured with E-type snap rings.

1) Option: up to 6 wheels per frame for load distribution

c. Slant Columns: A500 Grade B, tubular shape.
d. Cantilever Subassembly: Consists of ASTM A1011 Grade 50 nose connection plate, cantilever, and riser attachment plate welded together into a subassembly.

6. Lock system: Casterhorns at the end sections of powered banks (minimally), and manual sections, contain a Low Profile Posi-Lock LX to lock each row in open position and allow unlocking automatically. Provide adjustable stops to allow field adjustment of row spacings.
7. Sway Bracing: ASTM A653 grade 40, tension members bolted to columns.
8. Deck Stabilizer: A1011 Grade 45, member through-bolted to nose and riser at three locations per section. Securely captures front and rear edge of decking at rear edge of nose beam and lower edge of riser beam for entire length of section. Interlocks with adjacent stabilizer on upper tier using low-friction nylon roller to prevent separation and misalignment.

C. Fasteners: Vibration proof, in manufacturer's standard size and material.

2.7 ELECTRICAL OPERATION SYSTEMS

A. Integral Power

1. Default operation shall be with a removable pendant control unit which plugs into seating bank for tethered operator management of stop, start, forward, and reverse control of the power operation. Other modes of operation are optional.

B. PF1/2/3/4: Furnish and install Hussey PF(1/2/3/4), an integral automatic electro mechanical powered frame propulsion system, to open and close telescopic seating.

1. Electrical - Seating Manufacturer shall provide all wiring within seating bank, including pendant control. Motors, housing, and wiring shall be installed and grounded in complete accord with the National Electrical Code. The control system shall operate at low voltage (24V). The electrical contractor shall perform all connections at and upstream of the equipment specified herein and ensure that supplied voltage drops no more than 4% below nominal where power connects thereto.
2. Each unit for PF(1/2/3/4) is driven by a 1/2 horsepower, 1725 RPM motor.

    a. 208V 3 Phase:

        1) This 1.25 Service Factor motor runs on 208V at 60 Hz and draws a full load current of 1.8 amperes. The required power supply shall be 3 asynchronous phases of 120 Volts each, plus neutral plus ground, each with 20 Amp capacity.
        2) This system shall be UL Listed in its entirety (motors, circuit protection, motor controls, user interface, enclosures, conductors and connectors all evaluated and approved for correct sizing and compatibility under maximum rated load on the motors) under UL Product Category FHJU, titled Electrical Drive and Controls for Folding and Telescopic Seating.

    b. Each pair of Powered Frames shall consist of output shaft gear reducer with 6 inch diameter x 4 inch wide wheels covered with non-marring 1/2 inch thick composite rubber, and operate the bleacher as follows:

        1) PF4 – Pulls at 25 feet / min with 1 Hp through 111:1 speed reduction to 4 drive wheels. Max pull approximately 956 lbs.

C. Accessories:

1. Plug & Play Power

    a. The Plug & Play option enables safe cord and plug connection of the power system to the power supply, eliminates the need for a separate disconnect, and eliminates lockout tagout procedures at the bleacher. Electrical contractor shall provide and install the disconnect-rated receptacle and associated parts specified by the manufacturer. Manufacturer shall specify facility preparations for, and furnish and install a cord-and-plug connected power system. This option is available only with 208V 3 Phase.

2. Limit Switches

    a. Limit switches will automatically stop integral power operation when seating has reached the fully extended or closed position. Manufacturer shall furnish and install both open and closed limit switches for the integral power system. Power operation shall utilize a combination of contactors and limit switches to insure the wiring is not energized except during operation.

3. Remote Control

    a. The Remote Control option:

        1) Enables un-tethered operator management of stop, start, forward, and reverse control of the power system.
        2) Grants and confirms access only to an authorized controller, denying operation by spurious signals;

    b. Terminates access shortly after completed operation, requiring re-approval to resume operation.
    c. Manufacturer shall provide and install Access Control Unit and Remote Controller, and shall provide Remote Control Transmitters.

4. Key Switch Control

    a. Manufacturer shall furnish parts and instructions for installing a key-operated controller on the fixed structure of the facility.

5. Portable Power Assist

    a. Portable Power Assist is a walk-behind, self-contained portable electro-mechanical power unit enabling operator management of stop, start, forward, and reverse control of a bleacher. Multiple bleachers may be operated independently by attaching to / detaching from one bleacher and moving to another. None of the above described options are available with Portable Power Assist.
    b. Manufacturer to furnish and install two attachments for Portable Power Assist on every applicable section of bleacher and one Portable Power Assist unit per facility. Portable Power Assist shall have a 100’ long heavy duty cord and be cord and plug connected to a 120V 20 amp outlet convenient to the bleachers to be operated.
    c. Tractor unit shall be fitted with heavy-duty operating handle with convenient switches controlling forward / reverse separate from spring loaded on / off switch. Power drive unit shall consist of a gearmotor with dual output shafts and 6 inches diameter wheels covered with non-marring 1/2 inch thick molded polyurethane. Average operating speed shall be 35 feet / min.

2.8 TRANSPORT SYSTEMS

A. Integral Mechanical Dolly: Provide one pair of machine-screw-jack dollies; per section, for transport of movable telescopic sections. Each dolly shall be fitted with 6 inch, 360 degree swiveling kingpinless casters to insure ease of telescopic section movement. Wheel treads shall be molded polyurethane bonded to cast iron hubs with roller bearings. Dollies are integral to each section and shall be operated by a cordless drill through access holes in either the front or rear of the section. Dollies shall be designed to engage front and rear structural steel lift beams.

2.9 FABRICATION

A. Fabricate understructure from structural-steel members in size, spacing, and form required to support design loads specified in referenced safety standard.

B. Weld understructure to comply with applicable AWS standards.

C. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.

D. Form exposed sheet metal with flat, flush surfaces, level and true in line, and without cracking and grain separation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where telescoping stands are to be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Tolerances:

1. Flooring and rear wall: Level and plumb within 1/8 inch in 8 feet .
2. Maximum bleacher force on the floor of a 27 foot section: Static point load of less than 300 psi.

B. Install telescoping stands to comply with referenced safety standard and manufacturer's written instructions.

3.3 ADJUSTING AND CLEANING

A. On completion of installation, lubricate, test, and adjust each telescoping stand unit so that it operates according to manufacturer's written operating instructions.

B. Clean installed telescoping stands on exposed surfaces. Touch up shop-applied finishes or replace components as required to restore damaged or soiled areas.

3.4 MAINTENANCE SERVICE

A. Service Capability: Show proof of full time service capability by factory certified technicians directly employed by the installer.

1. A four to eight-hour maximum on-site repair response is required during normal working hours, 8 a.m. to 5 p.m. weekdays (excluding holidays).
2. All Full Time Service Personnel shall be Factory Authorized and Trained.
3. Provide proof of Service Capability and a list of service parts regularly maintained in inventory.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain telescoping stands.

3.6 DAMAGE REPLACEMENT

A. Replace damaged components prior to acceptance by Owner.

3.7 ADJUSTMENT AND CLEANING

A. Adjustment: After installation completion, lubricate, test and adjust each telescoping gym seats assembly to operate in compliance with manufacturer's operations manual.

B. Cleaning: Clean installed telescoping gym seats on both exposed and semi-exposed surfaces.

C. Touch-up finishes to restore damage or soiled surfaces.

3.8 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer to ensure telescoping gym seats are without damage or deterioration at time of substantial completion.

END OF SECTION 12 66 00

SECTION 12 93 13
BICYCLE STORAGE RACKS AND SKATEBOARD RACKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Bike racks.
2. Skateboard racks.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Maintenance Data: For site furnishings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of site furnishing(s) through one source from a single manufacturer.

1.5 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard 1-year warranty.

PART 2 - PRODUCTS

2.1 BIKE RACKS

A. Acceptable Products and Manufacturers:

1. Belson "U" Rack; Model #UX-238-SF-G.
2. Dero Bike Rack Co.; "Hoop Rack HD".
3. Madrax "U" Rack; Model #UX-238SF-G.

2.2 SKATEBOARD RACKS

A. Skateboard Rack: 2-1/2" "C" channel, 5/8" solid "U" rods, vinyl-coated security cables and 1-5/8" O.D. steel tubing, tamper-welded construction, double-sided, surface mounted.

1. Belson Outdoors: Model #SRS-DBL-8-SF-G.
2. Madrax: Model #SRS-DBL-8-G.

2.3 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves and lines.

B. Pipes and Tubes: Form curves by bending members to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.

C. Exposed Surfaces: All surfaces smooth, free of burrs, barbs, and sharpness; all edges and ends rolled, rounded, or capped.

2.4 FINISHES

A. Hot dipped galvanized heavy duty loop type 40 steel pipe conforming to the following specifications.

1. ASTM A312 standard specifications for zinc, hot dipped galvanized, coating on iron and steel pipe.
2. ASTM A53 standard specifications for pipe, steel, black, and hot-dipped, zinc coated, welded construction

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored and positioned at locations indicated on Drawings.

3.3 CLEANING

A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 12 93 13

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SECTION 12 95 00
BUILDING ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Ballet Bars and hardware.

1.3 SUBMITTALS

A. Product Data: Include material descriptions, dimensions, profiles, fastening and mounting methods, and finishes.

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of equipment or unit and for units exposed to view in same areas, unless otherwise approved by Architect.

PART 2 - PRODUCTS

A. Ballet Bars and hardware

1. Basis of Design Product and Manufacturer; VitaVibe WB15 Wall Barre Bracket.

a. Bracket: 1/4” thick powder coated steel bracket.
b. Finish: Powder Coated Finish.

1) Color: as selected by Architect from Manufacturers full range.

c. Rail: 1-1/2” diameter Red Oak, varnished.
d. Length and location: As indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that anchorage devices embedded in permanent construction are correctly sized and located.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION

A. Install accessories after other finishing operations, including painting, have been completed.

B. Wall-Mounted Accessory Units: Install accessories complying with manufacturer's printed instruction, using fasteners as recommended by manufacturer as appropriate to substrate.

3.3 PROTECTION

A. Comply with manufacturer's written recommendations and directions to protect accessories against damage during remainder of construction period and until Date of Substantial Completion.

END OF SECTION 12 95 00

Division 13

Special Construction

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SECTION 13 17 33
WHIRLPOOL TUBS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Whirlpool tubs and accessories.
2. Whirlpool Combination Table with seat.

1.3 ACTION SUBMITTALS

A. Make Submittals in accordance with Division 01 Section “Submittal Procedures.”

B. Product Data: For each type of product indicated. Include capacities, operating characteristics, dimensions, furnished accessories, and finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For whirlpool tubs to include in operation and maintenance manuals.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install whirlpool tubs until building is enclosed and wet work in spaces is complete and dry.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of turbine ejector and aerators that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of controls and safety mechanisms.
b. Deterioration or corrosion of metals or metal finishes.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Whitehall, Hi-Boy Whirlpool Stationary Model H-105-S, Legacy Model DF4828.

1. Capacity: 110 gallons.

B. Source Limitations: Obtain whirlpool tubs and components from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 WHIRLPOOL TUBS

A. Construction: Provide heavy-gauge, Type 304 stainless steel tank, formed, welded and finished into a seamless unit. Provide tank with a beaded rim, rounded and coved tub.

B. Coved, reinforced tank bottom.

C. Whirlpool Mixing Valve

1. Basis of Design Product and Manufacturer; Whitehall Manufacturing Model MXT15-OTG.

D. Variable Pressure Control

E. Backflow prevention: Provide the water inlet mounted above the rim.

F. Large drain: Provide a two-inch gravity drain on the floor of the tank. Provide a manually-operated valve on the outside wall of the tank to control drainage.

G. Thermometer: Provide a dual scale thermometer with adjustable calibration.

H. Turbine: 1/2 HP, 115 volts A/C, 60 Hz.

2.4 WHIRLPOOL COMBINATION TABLE WITH SEAT

A. Basis-of-Design Product: Subject to compliance with requirements, provide Whirlpool Combination Table with Seat, 24-inches high-boy, Fabrication Enterprises, Inc.

1. Finish: As selected by Architect from Manufacturers full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of whirlpool tubs.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before whirlpool installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF WHIRLPOOL TUBS

A. Comply with manufacturer's written instructions.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

C. Utilities: See Divisions 22 and 26 for plumbing and electrical requirements.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform visual, mechanical, and electrical inspection and testing according to manufacturers' written recommendations. Certify compliance with manufacturer's performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

C. A whirlpool will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain whirlpool tubes and turbines.

END OF SECTION 13 17 33

SECTION 13 34 17
ALUMINUM BLEACHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal bleachers, connections and the following:

1. Seating plan indicating aisles, walkways, seating sections and exits.
2. End elevation indicating rise and row depth, deck configurations, railings, size of framing members and walkways.

B. Delegated-Design Submittal: For bleachers, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation including:

a. Indication of Design loads

C. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

D. Qualification Data: For professional engineer.

1.3 QUALITY ASSURANCE

A. Engineer Qualification: The bleachers shall be designed under the supervision of a registered professional engineer.

B. Product Liability: Certification of Insurance coverage for the life of the product.

1.4 WARRANTY

A. Warranty: Bleachers shall be guaranteed for a minimum of five (5) years against defective material or workmanship.

PART 2 - PRODUCTS

2.1 PERFORMANCE

A. All material and workmanship shall be in accordance with the following:

1. Florida Building Code with Supplements; Current Edition.
2. Florida Accessibility Code.
3. NFPA-101, Life Safety Code, Current edition.
4. NFPA-102, Standard for Grandstands, folding and telescopic Seating, Tents, and Membrane Structures, Current Edition.
5. Aluminum Association of America
6. ASCE/SEI 7-05, Chapter 6.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design bleachers and railings, including attachment to building construction.

C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

   a. Uniform load of 50 lbf/ ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

   a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
   b. Infill load and other loads need not be assumed to act concurrently.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on bleachers by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MATERIALS

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

1. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
2. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
3. Extruded Bars and Tubing: ASTM B 221, Alloy 6063-T5/T52.
4. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.
5. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
6. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.
7. Plate and Sheet: ASTM B 209, Alloy 6061-T6.

2.3 PRODUCTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Alum-A-Stand bleachers by Dant Clayton Corporation or comparable product by one of the following:

1. E&D Specialty Stands
2. Southern Bleachers
3. Sturdisteel
4. Southeastern Seating

    a. Stairs: Fully closed.
    b. End Caps - Cast aluminum.
    c. Color: Clear Anodized.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners. Select fasteners for type, grade, and class required.

B. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 2.

C. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

2.5 MISCELLANEOUS MATERIALS

A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

B. Chain link fence; refer to Section 32 31 13.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form exposed work with accurate angles and surfaces and straight edges.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap metal as indicated to receive finish hardware, screws, and similar items.

G. Provide for anchorage of type indicated; coordinate with concrete slab layout. Space anchoring devices to secure bleachers rigidly in place and to support indicated loads.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install bleacher unit in accordance with manufacturer written instructions and shop drawings.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing bleachers. Set bleachers accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

END OF SECTION 13 34 17

SECTION 13 47 15
BULLET RESISTANT PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes

1. Bullet Resistant Panels.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Shop Drawings:

1. Submit shop drawings prepared by the manufacturer showing plans, sections, elevations, layouts, profiles and product component locations, including anchorage, fasteners, and accessories.

C. Design Data: Bullet resistance analysis design calculations for specific project conditions, certifying system conformance to specified performance requirements.

D. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified with a minimum documented experience of five years.

B. Installer Qualifications: Company specializing in installation of products specified with minimum three years documented experience.

C. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, and manufacturer's installation instructions.

D. Coordination of Work: Coordinate layout and installation of components with other construction supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system, and partitions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's unopened, undamaged packaging, with manufacturer's labels intact.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store assemblies, off the ground and on end, to prevent damage to face corners and edges.

D. Store assemblies covered to protect them from damage but permitting air circulation.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

A. Materials and workmanship shall be warranted against defects for a period of two (2) years from the date of receipt at the project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Level 3 - Ballistic Rating

1. Basis of Design Manufacturer; ArmorTEX, O.F. 300, Opaque Fiberglass, or subject to compliance with requirements other Acceptable Manufacturers which may be incorporated into the work are but not limited to the following:

   a. ArmorCore by Waco Composites.
   b. Bulldog Direct Protective Systems, Inc.
   c. Total Security Solutions.

2. Panel Rating: UL752 Level 3.
3. Nominal Thickness: 1/2-inch.
4. Performance Level: Underwriters Laboratory UL 752 11th Edition Standard for Bullet Resisting Equipment. One-hour fire rated to ASTM E119-00a Building Construction and Materials.
5. Ammunition Tested: .44 magnum lead semi-wadcutter gas checked, 240 grain, 1350 fps, 3 shots

2.2 APPLICATIONS/SCOPE

A. Bullet resistant protection shall be provided in the sizes and in the configuration indicated on the Drawings.

B. Provide components complete with adhesive, fasteners, and other devices required for complete assembly.

2.3 BULLET RESISTANT PANELS

A. Multiple layers of woven roving ballistic grade fiberglass woven in house impregnated with a thermoset polyester resin and compressed into flat rigid sheets designed to capture projectiles.

B. Bullet resistance of joints: equal to that of the panel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until openings and installing surfaces have been properly prepared.

3.2 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of UL 752.

B. Install using self-tapping drywall screws. Pre drilling may be required on 1 3/16” and thicker material. Drill using high speed steel twist drill bits. We recommend that you incorporate 4“overlap strips (battens) at seams.

END OF SECTION 13 47 15

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Division 14

Conveying Systems

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SECTION 14 24 00
HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes: Hydraulic passenger elevators as shown and specified. Elevator work includes:

1. Standard pre-engineered hydraulic passenger elevators.
2. Elevator car enclosures, hoistway entrances and signal equipment.
3. Operation and control systems.
4. Jack(s).
5. Accessibility provisions for physically disabled persons.
6. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
7. Materials and accessories as required to complete the elevator installation.

B. Related Sections:

1. Division 1 General Requirements: Meet or exceed all referenced sustainability requirements.
2. Division 3 Concrete: Installing inserts, sleeves and anchors in concrete.
3. Division 4 Masonry: Installing inserts, sleeves and anchors in masonry.
4. Division 5 Metals:

    a. Providing hoist beams, pit ladders, steel framing, auxiliary support steel and divider beams for supporting guide-rail brackets.
    b. Providing steel angle sill supports and grouting hoistway entrance sills and frames.

5. Division 9 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
6. Division 16 Sections:

    a. Providing electrical service to elevators, including fused disconnect switches.
    b. Emergency power supply, transfer switch and auxiliary contacts.
    c. Heat and smoke sensing devices.
    d. Convenience outlets and illumination in control room, hoistway and pit.

7. Division 22 Plumbing

    a. Sump pit and oil interceptor.

8. Division 23 Heating, Ventilation and Air Conditioning

e. Heating and ventilating hoistways and/or control room.

C. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Part 3 for hydraulic elevators. State or local requirements must be used if more stringent. The cost of this work is not included in the TK Elevator's proposal, since it is a part of the building construction.

1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
3. Hatch walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
4. Elevator hoistways shall have barricades, as required.
5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
9. Machine room to be enclosed and protected.
10. Machine Room temperature must be maintained between 55º and 90º F.
11. If machine room is remote from the elevator hoistway, clear access must be available above the ceiling or metal/concrete raceways in floor for oil line and wiring duct from machine room.
12. Access to the machinery space and machine room must be in accordance with the governing authority or code.
13. Provide an 8" x 16" cutout through machine room wall, for oil line and wiring duct, coordinated with elevator contractor at the building site.
14. All wire and conduit should run remote from the hoistways.
15. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
16. Install and furnish finished flooring in elevator cab.
17. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
18. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
19. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
20. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.
21. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
22. General Contractor shall fill and grout around entrances, as required.
23. Elevator sill supports shall be provided at each opening.
24. All walls and sill supports must be plumb where openings occur.

25. For applications with jack hole, free and clear access to the elevator pit area for the jack hole-drilling rig is required.
26. Where jack hole is required, remove all spoils from jack hole drilling.
27. When not provided by Elevator Contractor, jack hole shall accommodate the jack unit. If required the jack hole is to be provided in strict accordance with the elevator contractor's shop drawings.
28. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
29. A light switch and fused disconnect switch for each elevator should be located inside the machine room adjacent to the door, where practical, per the National Electrical Code (NFPA No. 70).
30. For signal systems and power operated door: provide ground and branch wiring circuits, including main line switch.
31. For car light and fan: provide a feeder and branch wiring circuits, including main line switch.
32. Wall thickness may increase when fixtures are mounted in drywall. These requirements must be coordinated between the general contractor and the elevator contractor.
33. Provide supports, patching and recesses to accommodate hall button boxes, signal fixtures, etc..
34. Locate telephone and convenience outlet on control panel.

1.3 SUBMITTALS

A. Product data: When requested, the elevator contractor shall provide standard cab, entrance and signal fixture data to describe product for approval.

B. Shop drawings:

1. Show equipment arrangement in the corridor, pit, and hoistway and/or optional control room. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
4. Indicate electrical power requirements and branch circuit protection device recommendations.

C. Powder Coat paint selection: Submit manufacturer’s standard selection charts for exposed finishes and materials.

D. Plastic laminate selection: Submit manufacturer’s standard selection charts for exposed finishes and materials.

E. Metal Finishes: Upon request, standard metal samples provided.

F. Operation and maintenance data. Include the following:

1. Owner’s manuals and wiring diagrams.
2. Parts list, with recommended parts inventory.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: An approved manufacturer with minimum 15 years of experience in manufacturing, installing, and servicing elevators of the type required for the project.

1. The manufacturer of machines, controllers, signal fixtures, door operators cabs, entrances, and all other major parts of elevator operating equipment.

a. The major parts of the elevator equipment shall be manufactured by the installing company, and not be an assembled system.

2. The manufacturer shall have a documented, on-going quality assurance program.
3. ISO-9001:2000 Manufacturer Certified
4. ISO-14001:2004 Environmental Management System Certified
5. LEED Gold certified elevator manufacturing facility.

B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than 15 years of satisfactory experience installing elevators equal in character and performance to the project elevators.

C. Regulatory Requirements:

1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
2. Building Code: National.
3. NFPA 70 National Electrical Code.
4. NFPA 80 Fire Doors and Windows.
5. Americans with Disabilities Act - Accessibility Guidelines (ADAAG)
6. Section 407 in ICC A117.1, when required by local authorities
7. CAN/CSA C22.1 Canadian Electrical Code
8. CAN/CSA B44 Safety Code for Elevators and Escalators.
9. California Department of Public Health Standard Method V1.1–2010, CA Section 01350

D. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(b), and NFPA Standard 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).

E. Inspection and testing:

1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
2. Arrange for inspections and make required tests.
3. Deliver to the Owner upon completion and acceptance of elevator work.

F. Sustainable Product Qualifications:

1. Environmental Product Declaration:

a. GOOD: If Product Category Rules (PCR) are not available, produce a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.

b. BEST: If Product Category Rules (PCR) are available, produce and publish an Environmental Product Declaration (EPD) based on a critically reviewed life-cycle assessment conforming to ISO 14044, with external verification recognized by the EPD program operator.

2. Material Transparency:

a. GOOD: Provide Health Product Declaration at any level
b. BETTER: Provide Health Product Declaration (HPD v2 or later). Complete, published declaration with full disclosure of known hazards, prepared using the Health Product Declaration Collaborative's "HPD builder" on-line tool.
c. BEST: Cradle to Cradle Material Health Certificate v3, Bronze level or higher.

3. LEED v4 – Provide documentation for all Building Product Disclosure AND Optimization credits in LEED v4 for product specified.
4. Living Building Challenge Projects: Provide Declare label for products specified.

1.5 DELIVERY, STORAGE AND HANDLING

A. Manufacturing shall deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

1.6 PROJECT CONDITIONS

A. Temporary Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

B. Provide the hole for the jack unit (if required by the type of jack provided), based on excavation through normal soil or clay which can be removed by manual digging or by standard truck-mounted regular drilling unit. Provide a casing if required to retain the walls of the hole. General contractor shall remove excavation spoils deposited in the elevator pit.

1. If a physical obstruction or hindrance is encountered below the ground surface, including boulders, rock, gravel, wood, metal, pilings, sand, water, quick sand, caves, public utilities or any other foreign material, obtain written authorization to proceed with excavating using special excavation equipment.
2. Maintain a daily log of time and material costs involved.
3. Elevator contractor will be compensated on a time and material basis for additional costs incurred after encountering the physical obstruction or hindrance, including the cost of the special excavation equipment.

1.7 WARRANTY

A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months after final acceptance.

1.8 MAINTENANCE

A. Furnish maintenance and call back service for a period of 12 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours excluding callbacks.

1. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Maintenance work, including emergency call back repair service, shall be performed by trained employees of the elevator contractor during regular working hours.
2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
3. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer and Product: ThyssenKrupp Elevator, Endura hydraulic elevator, or subject to compliance with requirements, a comparable product by one of the following:

1. Otis Elevator Co.
2. Schindler Elevator Corp.

B. Source Limitations: Obtain elevators from single manufacturer.

2.2 MATERIALS, GENERAL

A. All Elevator Cab materials including frame, buttons, lighting, wall and ceiling assembly, laminates and carpet shall have an EPD and an HPD, and shall meet the California Department of Public Health Standard Method V1.1–2010, CA Section 01350 as mentioned in 1.03.9 of this specification.

B. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.

C. Steel:

1. Shapes and bars: Carbon.
2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
3. Finish: Factory-applied powder coat for structural and architectural parts. Color selection must be based on elevator manufacture’s standard selections.

D. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness. Laminate selection must be based on elevator manufacture’s standard selections.

E. Flooring by others.

2.3 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.

B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.

D. Guides: Slide guides shall be mounted on top and bottom of the car.

E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.

F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to ensure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless. Two jacks piped together, mounted one on each side of the car with a polished steel hydraulic plunger housed in a sealed steel casing having sufficient clearance space to allow for alignment during installation. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section..

G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. Provide proper grade inherently biodegradable oil as specified by the manufacturer of the power unit (see Power Unit section 2.04.G for further details)

2.4 POWER UNIT

A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit consisting of the following items:

1. An oil reservoir with tank cover.
2. An oil hydraulic pump.
3. An electric motor.
4. An oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.

B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.

C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating shall be selected for specified speed and load.

D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.

1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
5. Provided with constant speed regulation in both up and down direction. Feature to compensate for load changes, oil temperature, and viscosity changes.
6. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
7. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

2.5 HOISTWAY ENTRANCES

A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.

1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
2. Main landing door & frame finish: Stainless steel panels, no. 4 brushed finish with no. 4 brushed finish entrance frame.
3. Typical door & frame finish: Stainless steel panels, no. 4 brushed finish with no. 4 brushed finish entrance frame.

B. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.

C. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.

1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.

3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

D. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

2.6 PASSENGER ELEVATOR CAR ENCLOSURE

A. Car Enclosure:

1. Walls: Cab type TKAP, reinforced cold-rolled steel with two coats factory applied baked enamel finish, with applied vertical wood core panels covered on both sides with stainless steel: ASTM A 167, stainless steel panels, No. 4 satin finish.
2. Reveals and frieze: a. Reveals and frieze: Stainless steel, no. 4 brushed finish
3. Canopy: Cold-rolled steel with hinged exit.
4. Ceiling: Downlight type, metal pans with suspended LED downlights and dimmer switch. Number of downlights shall be dependent on platform size with a minimum of six. The metal pans shall be finished with a stainless steel, no. 4 brushed finish.
5. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with brushed stainless steel
6. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
7. Door Finish: Stainless steel panels: No. 4 brushed finish.
8. Cab Sills: Extruded aluminum, mill finish.
9. Handrail: Provide 1.5' diameter cylindrical metal on side and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, no. 4 brushed finish.
10. Ventilation: Manufacturer’s standard exhaust fan, mounted on the car top.
11. Protection pads and buttons: Not required

B. Car Top Inspection: Provide a car top inspection station with an “Auto-Inspection” switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.7 DOOR OPERATION

A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.

1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.

2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to answer the other call.
4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.
8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.8 CAR OPERATING STATION

A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Wrap return shall have a brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED’s shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.

B. Emergency Communications System: Integral phone system provided.

C. Auxiliary Operating Panel:

D. Column Mounted Car Riding Lantern: Not required for this application.

E. Special Equipment: Not Applicable

2.9 CONTROL SYSTEMS

A. Controller: The elevator control system shall be microprocessor based and software oriented. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.

B. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

C. Emergency Power Operation: (Battery Lowering 10-DOC) When the loss of normal power is detected, a battery lowering feature is to be activated. The elevator will lower to a predetermined level and open the doors. After passengers have exited the car, the doors will close and the car will shutdown. When normal power becomes available, the elevator will automatically resume operation. The battery lowering feature is included in the elevator contract and does not utilize a building-supplied standby power source.

D. Special Operation: Not Applicable

2.10 HALL STATIONS

A. Hall Stations, General: Vandal resistant buttons with center jewels which illuminate to indicate that a call has been registered at that floor for the indicated direction. Each button shall be provided with an internal automatic stop to prevent damage of switches that register the call. Provide 1 set of pushbutton risers. All fixtures shall be vandal resistant type.

1. Provide one pushbutton riser with faceplates having a brushed stainless steel finish.

    a. Phase 1 firefighter’s service key switch, with instructions, shall be incorporated into the hall station at the designated level.

B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.

C. Hall Position Indicator: Not Applicable

D. Hall lanterns: A hall lantern with adjustable chime shall be provided at each landing and located adjacent to the entrance. The lanterns, when illuminated, shall indicate the elevator car that shall stop at the landing and in what direction the car is set to travel. When the car reaches a predetermined distance from the floor where it is going to stop, the corresponding hall lantern shall illuminate and the chime shall sound. The hall lantern shall remain illuminated until the car doors close in preparation for leaving the floor. Illumination of the arrow shall be with LED’s. Faceplates shall match the hall station finish. Provide at all typical landings.

E. Special Equipment: Not Applicable

2.11 MISCELLANEOUS ELEVATOR COMPONENTS

A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and/or control room, as constructed, verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.2 INSTALLATION

A. Install elevator systems components and coordinate installation of hoistway wall construction.

1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
2. Comply with the National Electrical Code for electrical work required during installation.

B. Jack unit excavation (if required by the type of jack provided): Drill or otherwise excavate below elevator pit construction as required to install the jack unit.

1. Install casing for jack unit.
2. Provide HDPE jack protection system for all in ground jacks.
3. Set casing for jack unit assembly plumb, and partially fill with water set¬tled sand, eliminating voids. Back fill depth shall be sufficient to hold the bottom of the jack in place over time.

C. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.

D. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.

E. Welded construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualification of welding operators.

F. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.

G. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.

H. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.

I. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascia and toe guards after rough walls finished. Set sill units accurately aligned and slightly above finish floor at landings.

J. Lubricate operating parts of system, where recommended by manufacturer.

3.3 FIELD QUALITY CONTROL

A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by Code and governing regulations or agencies. Perform other tests, if any, as required by governing regulations or agencies.

B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

3.4 ADJUSTING

A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.5 CLEANING

A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive surface; it shall not be cleaned with bleach-based cleansers.

B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.

1. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

3.6 PROTECTION

A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.7 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.

B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

3.8 ELEVATOR SCHEDULE

A. Elevator Qty. 1

1. Elevator Model: endura Twinpost above-ground 1-stage
2. Elevator Type: Hydraulic Passenger
3. Rated Capacity: 3500 lbs.
4. Rated Speed: 110 ft./min.
5. Operation System: TAC32H
6. Travel: 14'-8"
7. Landings: 2 total
8. Openings:
9. Front: 2
10. Rear: 0
11. Clear Car Inside: 6'-8" wide x 5'-5" deep
12. Inside clear height: 8'-4" standard
13. Door clear height: 7'-0" standard
14. Hoistway Entrance Size: 3'-6" wide x 7'-0" high
15. Door Type: One-speed | LH Side opening
16. Power Characteristics: 460 volts, 3 Phase, 60 Hz.
17. Seismic Requirements: No
18. Hoistway Dimensions: 8'-4" wide x 6'-11" deep
19. Pit Depth: 4'-0"
20. Button & Fixture Style: Vandal Resistant Signal Fixtures
21. Special Operations: None

3.9 SPECIAL CONDITIONS (Note: Add Special Conditions as Needed)

END OF SECTION 14 24 00

Project Manual

High School DDD

prepared for:

St. Lucie Public Schools

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PHASE III CONSTRUCTION DOCUMENTS

Volume 2 of 2

- Divisions 21 thru 33

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ST. LUCIE PUBLIC SCHOOLS
HIGH SCHOOL DDD
PHASE III CONSTRUCTION DOCUMENTS

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Division 21

Fire Suppression Systems

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SECTION 21 01 00
GENERAL FIRE PROTECTION PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE OF DIVISION

A. Work shall include all materials, equipment and labor necessary for a complete and properly functioning mechanical installation in accordance with all applicable codes, and contract drawings and specifications. Work shall include all work specified in Division-21, FIRE PROTECTION.

B. Pay for all required licenses, fees, inspections and permits.

1.3 RELATION TO OTHER WORK

A. Work Not in Division 21: Related work not included in this division consists of requirements given in the following as may be included in the contract documents:

1. Other divisions which may include work (such as concrete, steel, painting, ceiling systems, structure and other work) related to the work of Division 21.

B. Work of Division 21: Any or all sections of Division 21 may include a paragraph or paragraphs under the heading, "Relation to other Work". Where such a paragraph is indicated and work directly related to the section is listed or described, such work shall be considered as relating directly to the indicated section. Any related work (directly related or otherwise) which may be omitted by reference from the "Relation to Other Work" paragraph of such section(s), shall be provided as necessary and required whether or not such work is included by reference. Such listing or description of related work within a section is given only as a convenience to the Contractor; omission of other related sections or described work does not in any way exclude the provision of such work.

1.4 CODES

A. Install all work in accordance with the latest edition of all applicable regulations and governing codes, including the regulations of the utility companies serving the project.

B. Where a conflict in code requirements occurs the more stringent requirement shall govern.

1.5 STANDARDS

A. All equipment and devices shall bear U.L. label.

1.6 DRAWINGS

A. Architectural and structural drawings take precedence over fire protection drawings with reference to the building construction. Fire protection drawings are diagrammatic and indicate the general arrangement and extent of work. Architectural drawings indicate more exactly the desired relationship between fire sprinkler heads, diffusers, registers, lighting fixtures, equipment, electric panels and devices, plumbing fixtures, and other items which remain exposed in the completed building. Exact locations and arrangement of materials and equipment shall be determined, with the acceptance of the Architect/Engineer, as work progresses to conform in the best possible manner with the surroundings and with the adjoining work of other trades. Where locations of equipment, devices or fixtures are controlled by architectural features, establish such locations by referring to dimensions on Architectural drawings and not by scaling drawings.

1.7 DISCREPANCIES

A. In case of differences between drawings and specifications, or where drawings and specifications are not clear or definitive, the more stringent requirement shall apply. Any such discrepancies shall be referred to Architect/Engineer for clarification and instructions.

1.8 ELECTRICAL PROVISIONS

A. Work of Division 21 shall include the electrical requirements which are indicated to be integral with fire protection work and which can be summarized to include (but not necessarily be limited to) the following:

1. Motors & Control Panels
2. Unless shown otherwise, motor & control panels are to be furnished by fire protection contractor and wired by electrical contractor.
3. Drip pans to protect electrical work.

1.9 ELECTRICAL/FIRE PROTECTION WORK

A. Definitions: Definitions for the purpose of fire protection/electrical control and power coordination are as follows: (Note: The use of the words, "Provide", "furnish" and "install" are intended only for use in describing the coordination indicated by this paragraph and do not necessarily have the same definitions when used outside of the context of this paragraph.) Any items which do not fall within the scope of this paragraph shall be coordinated as individually specified.

1. "Furnish" means to procure an item and to deliver it to the project for installation.
2. "Install" means to determine (in coordination with others as necessary) the appropriate intended location of an item and to set and connect it in place.
3. "Provide" means to both furnish and install.
4. Controller: A device, or group of devices, which serves to govern, in some predetermined manner, electric power delivered to apparatus to which the controller is connected and includes any switch or device normally used to start and stop a motor. (See NEC, Article 100, Definitions, "Controller", and Section 430-81(a).)

B. Work of Division-21 includes (but is not necessarily limited to):

1. Provide:

a. All control connections to equipment.
b. All control connections to controllers, motors and other fire protection systems electrical power consuming equipment (such as heat trace cable)

2. Furnish:

a. All fire protection controllers under Division-21.

C. Work of Division-26 includes (but is not necessarily limited to):

1. Provide:

a. All power connections to controllers, motors and other fire protection systems electrical power consuming equipment (heat trace cable)
b. All controllers.

2. Install:

a. All controllers under Division-21 equipment.

1.10 AUXILIARIES AND ACCESSORIES

A. Include all auxiliaries and accessories for complete and properly operating systems.

1.11 INVESTIGATION OF SITE

A. Check site and existing conditions thoroughly before bidding. Advise Architect/Engineer of discrepancies or questions noted before bidding.

1.12 COORDINATION

A. Provide all required coordination and supervision where work of this division connects to or is affected by work of others.

1.13 PROVISIONS FOR OPENINGS

A. Provide all openings required for work performed under Division-21. Provide sleeves or other approved methods to allow passage of items installed under any Section of Division-21.

1.14 INTERRUPTION OF EXISTING SERVICES

A. Any interruption of existing services shall be coordinated in advance with the Owner's Representative. Shutdown time and duration of critical services shall be decided by the Owner. Contractor shall provide shutoff valves at point of tie-in to minimize downtime.

1.15 CLEANING AND PROTECTION

A. Piping: Keep the interior of the piping systems free from dirt and rubbish and other foreign matter. Thoroughly clean piping and remove all dirt, scale, oil and other foreign substances which may have accumulated during the installation process.

B. Equipment: All fire protection equipment provided shall be thoroughly cleaned of all dirt, oil, concrete, etc. Any dents, scratches or other visible blemishes shall be corrected, and the appearance of the equipment made "like new" and to the satisfaction of the Architect/Engineer.

C. Upon completion, and before final acceptance of the work, all debris, rubbish, leftover materials, tools and equipment shall be removed from the site.

D. Protection of Work Until Final Acceptance: Protect all materials and equipment from damage, entrance of dirt and construction debris from the time of installation until final acceptance. Any materials and equipment which are damaged shall be repaired to "as new" condition or replaced at the direction of the Architect/Engineer. Where factory finishes occur and damage is minor, finishes may be touched up. If, in the opinion of the Architect/Engineer the damage is excessive, factory finish shall be replaced to "new" condition.

1.16 SHOP DRAWINGS

A. Submit shop drawings for all items, services and systems included in the project.

B. Shop drawings shall clearly show the following:

1. Technical and descriptive data in detail equal to or greater than the data given in the item specification. Indicate all characteristics, special modifications and features. Where performance and characteristic data is shown on the drawings or specified, submitted data shall be provided in a degree which is both quantitatively and qualitatively equal to that specified and shown so that comparison can be made. Present data in detail equal to or greater than that given in item specification and include all weights, deflections, speeds, velocities, pressure drops, operating curves, temperature ratings, dimensions, sizes, manufacturers' names, model numbers, types of material used, operating pressures, full load amperages, starting amperages, capacities, set points, chemical compositions, certifications and endorsements, operating voltages, thicknesses, gauges and all other related information as applicable to particular item.
2. Exceptions to or deviations from the contract documents. Should Architect/Engineer accept any items having such deviations which are not clearly brought to Architect/Engineer's attention, in writing, on item submittal, then Contractor is responsible for correction of such deviations regardless of when such deviations are discovered.

C. Additional Requirements: See specific sections of the Specifications for any additional requirements.

1.17 SHOP DRAWINGS TECHNICAL INFORMATION SUBMITTALS

A. All submittals are to be submitted electronically in the form of PDF. One PDF file shall be provided for all specification sections that require submittals to be provided.

B. A cover page shall have adequate space for Contractor, Subcontractor and Engineer review stamps and indicate the following minimum data:

1. Project Name
2. Project Address
3. Contractor Name
4. Subcontractor Name
5. Specification Section Number
6. Specification Section Name
7. Submittal Date

C. All shop drawings and equipment submittals shall be submitted complete based on specification division. Partial submittals of each specification section will not be accepted.

D. All submittals shall have been reviewed for compliance by the Contractor and associated subcontractor prior to submission to the Engineer. A stamp bearing the name of the reviewer and date review was completed shall be on the cover page of the submittal.

E. Submittal data shall be logically grouped based on equipment tags or like material. For submittals that contain data on multiple materials or equipment, it shall be clearly noted by equipment tag or applicable material.

F. Manufacturer's data indicating multiple options or choices shall be clearly noted as to what is applicable to the material and equipment being provided. Information not applicable should be struck through or extracted.

1.18 SHOP DRAWINGS FOR PIPING SYSTEMS

A. Shop drawings for piping systems shall be performed by the installing subcontractors. Shop drawings shall show all required maintenance and operational clearances required. Title drawings shall include identification of project and names of Architect, Engineer, Contractor, subcontractor and/or supplier, date, be numbered sequentially and shall indicate the following:

1. Architectural and structural backgrounds with room names and numbers, etc., including but not limited to plans, sections, elevations, details, etc.

a. Fabrication and Erection dimensions.
b. Arrangements and sectional views.
c. Necessary details, including complete information for making connections with other work.
d. Kinds of materials and finishes.
e. Descriptive names of equipment.
f. Modifications and options to standard equipment required by the contract.

B. Also provide shop drawings, using architectural reflected ceiling plans, which indicate locations of the following (to be verified by Contractor): Air distribution devices, sprinkler heads, lights, access panels, fire alarm, speakers, projectors or any system device intended to be installed in the ceiling.

C. Shop drawings shall be submitted in electronic PDF format and shall bear the review stamp from the mechanical subcontractor and general contractor / CM that it has been reviewed for compliance.

D. See specific sections of specifications for further requirements.

1.19 ELECTRONIC FILES

A. CADD files will be available on a limited basis to qualified firms at the Architect's / Engineer's prerogative. Recipients are cautioned that these files may not accurately show actual conditions as constructed. Users are responsible to verify actual field conditions. These files are not intended to be used as shop drawings.

B. Any requests for electronic files shall be preceded by processing the required electronic file release form and submitting to the Engineer for authorization. Request for electronic files should be submitted through the Contractor for submission to the Architect / Engineer.

1.20 OPERATING INSTRUCTIONS

A. Submit for checking a specific set of written operating instructions on each item which requires instructions to operate. After acceptance, insert information in each Technical Information Brochure. Refer also to other sections which may describe operating instructions.

1.21 MAINTENANCE INFORMATION

A. Submit for acceptance Maintenance Information consisting of manufacturer's printed instruction and parts lists for each major item of equipment. After acceptance, insert information in each Technical Information Brochure. Refer also to other sections which may describe maintenance.

1.22 MANUFACTURER'S CHECK-OUT

A. Check out by Manufacturer's Representative (for major items of equipment): At completion of construction and after performance verification information as above-mentioned has been gathered, submitted and accepted, provide one copy of this information to the manufacturer's representative. Work required under this section shall include having the representative examine the performance verification information, check the equipment in the field while it is operating, and sign a Check-Out Memo for record. Submit a copy of the memo on each major item of equipment for each brochure. Accepted memos shall be inserted on each brochure with the performance verification information and submittal data. Memos shall be submitted and accepted before Instruction in Operation to Owner or a request for final inspection.

1.23 SYSTEM GUARANTEE

A. The work required under Division-21 shall include a one-year guarantee. This guarantee shall be by the Contractor to the Owner to replace for the Owner any defective workmanship, equipment, or material which has been furnished under this Contract at no cost to the Owner for a period of one year from the date of acceptance of the System. This guarantee shall also include reasonable adjustments of the system required for proper operation during the guarantee period. Explain the provisions of guarantee to Owner at the "Instruction in Operation Conference".

1.24 INSTRUCTION TO OWNER

A. Submit all required items for checking one week before final inspection of the building is scheduled. When all items are accepted and placed in the proper brochures, the Contractor shall give notice in writing that he is ready to give the Owner an "Instruction in Operation Conference". After the above mentioned request is received the Contractor will be notified of the time the conference can be held with the Owner. At the conference, the Contractor shall review with the Owner all appropriate information. At the end of the conference, seven copies of a memo certifying Instruction in Operation and Completed Demonstration shall be signed by the Contractor, Subcontractor and Owner and one copy inserted in each brochure.

1.25 MATERIALS AND EQUIPMENT

A. Each bidder represents that his bid is based upon the materials and equipment described in this division of the specifications.

1. Submittal shall include the name of the material or equipment for which it is to be substituted, substituted equipment model numbers, drawings, cuts, performance and test data and any other data or information necessary for the Architect/Engineer to determine that the equipment meets all specification and requirements. If the Architect/Engineer accepts any proposed substitutions, such acceptance will be set forth in writing.
2. Substituted equipment with all accessories installed or optional equipment where permitted and accepted, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether accepted or not, shall be replaced at the Contractor's expense. Any modifications of related systems of this or other trades as a result of substitutions shall be made at the Contractor's expense, and Contractor shall so state in his written request for substitution.

B. Acceptable Manufacturers: Materials and Equipment specified in these contract documents are accepted only in regard to general performance and quality. It shall be the Contractor's responsibility to ensure that acceptable materials and equipment meet or exceed the efficiencies, capacities, electrical characteristics, performance and quality of the equipment herein specified. Acceptable equipment must also generally conform, without extensive modification of related systems to the accessories, weights, space and maintenance requirements, etc., of the specified equipment. Any modification to related systems of this or other trades shall be made at the Contractor's expense and the Contractor shall be responsible for coordination between trades. Any difference in capacity, efficiency, electrical characteristics, weights or quality of product, etc., between specified materials and equipment and acceptable alternates shall be submitted to the Architect/Engineer for acceptance within 30 days of Notice to Proceed.

C. If no prior approval for substitutions or alternate manufacturers have been provided, the bid must conform with the requirements of the plans and specifications. No equipment substitutions or alternate manufacturers will be considered once the project bidding has ended.

PART 2 - PRODUCTS

2.1 Section part not applicable.

PART 3 - EXECUTION

3.1 Section part not applicable.

END OF SECTION 21 01 00

SECTION 21 05 17
SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.
4. Silicone sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.

B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, with plain ends and integral welded waterstop collar.

D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.
4. Metraflex Company (The).
5. Proco Products, Inc.

B. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig minimum.
3. Sealing Elements: High-temperature-silicone interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
4. Pressure Plates: Stainless steel.
5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.4 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dow Corning Corporation.
b. GE Construction Sealants; Momentive Performance Materials Inc.
c. Polymeric Systems, Inc.
d. Schnee-Morehead, Inc., an ITW company.
e. Sherwin-Williams Company (The).

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. May National Associates, Inc.; a subsidiary of Sika Corporation.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 07 84 13 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.
b. Piping NPS 6 and Larger: Steel pipe sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.
b. Piping NPS 6 and Larger: Steel pipe sleeves.

5. Interior Partitions:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.

b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 21 05 17

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SECTION 21 05 18
ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.

c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 21 05 18

SECTION 21 05 23
GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Iron butterfly valves with indicators.
2. Check valves.
3. Indicator posts.
4. Trim and drain valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Main Level: HAMV - Fire Main Equipment.

a. Level 1: HCBZ - Indicator Posts, Gate Valve.
b. Level 1: HLOT - Valves.

1) Level 3: HLUG - Ball Valves, System Control.
2) Level 3: HLXS - Butterfly Valves.
3) Level 3: HMER - Check Valves.
4) Level 3: HMRZ - Gate Valves.

2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.

a. Level 1: VQGU - Valves, Trim and Drain.

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:

a. Indicator posts.
b. Valves.

1) Gate valves.

2) Check valves.

a) Single check valves.

3) Miscellaneous valves.

C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

D. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
2. ASME B1.20.1 for threads for threaded-end valves.
3. ASME B31.9 for building services piping valves.

E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

F. NFPA Compliance: Comply with NFPA 24 for valves.

G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.

H. Valve Sizes: Same as upstream piping unless otherwise indicated.

I. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.2 IRON BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anvil International.
2. Fivalco Inc.
3. Globe Fire Sprinkler Corporation.
4. Kennedy Valve Company; a division of McWane, Inc.
5. NIBCO INC.
6. Tyco Fire Products LP.
7. Victaulic Company.
8. Zurn Industries, LLC.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.

7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Body Design: Grooved-end connections.

2.3 CHECK VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anvil International.
2. Fire Protection Products, Inc.
3. Fivalco Inc.
4. Globe Fire Sprinkler Corporation.
5. Kennedy Valve Company; a division of McWane, Inc.
6. Matco-Norca.
7. Mueller Co.
8. NIBCO INC.
9. Reliable Automatic Sprinkler Co., Inc. (The).
10. Shurjoint Piping Products USA Inc.
11. Tyco Fire Products LP.
12. United Brass Works, Inc.
13. Venus Fire Protection Ltd.
14. Victaulic Company.
15. Viking Corporation.
16. WATTS.
17. Wilson & Cousins Inc.
18. Zurn Industries, LLC.

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.4 TRIM AND DRAIN VALVES

A. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire Protection Products, Inc.
b. NIBCO INC.
c. United Brass Works, Inc.

2. Description:

   a. Pressure Rating: 175 psig
   b. Body Material: Brass or bronze.
   c. Ends: Threaded.
   d. Stem: Bronze.
   e. Disc: Bronze.
   f. Packing: Asbestos free.
   g. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

A. Comply with requirements in the following Sections for specific valve installation requirements and applications:

   1. Section 21 13 13 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the pipe center.

F. Install valves in position to allow full stem movement.

G. Install valve tags. Comply with requirements in Section 21 05 53 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

END OF SECTION 21 05 23

SECTION 21 05 29
HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Metal framing systems.
3. Trapeze pipe hangers.
4. Fastener systems.
5. Equipment supports.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations.

C. Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria. Submit with shop drawings for review and approval

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to "2015 ASME Boiler and Pressure Vessel Code, Section IX."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. NFPA Compliance: Comply with NFPA 13.

D. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. B-line, an Eaton business.
b. Empire Tool and Manufacturing Co., Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head; Illinois Tool Works, Inc.
e. MKT Fastening, LLC.

2. Indoor Applications: Zinc-coated or stainless steel.
3. Outdoor Applications: Stainless steel.

2.5 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.6 MATERIALS

A. Aluminum: ASTM B 221.

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A 240/A 240M.

E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.

D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

F. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

G. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and corrosion-resistant attachments for hostile environment applications.

G. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.
3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

I. Hanger-Rod Attachments: Comply with NFPA requirements.

J. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. C-Clamps (MSS Type 23): For structural shapes.
3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

K. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

L. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 21 05 29

SECTION 21 05 53
IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Stainless steel, 0.025 inch thick, with predrilled holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: White.

D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

E. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

F. Fasteners: Stainless-steel rivets or self-tapping screws.

G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

H. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; pipe size; and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 LABEL INSTALLATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install or permanently fasten labels on each major item of mechanical equipment.

D. Locate equipment labels where accessible and visible.

E. Piping Color-Coding: Refer to Architectural drawings for painting of piping specified.

F. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

END OF SECTION 21 05 53

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SECTION 21 13 13
WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

1.2 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.3 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

B. Design: Shall comply with design criteria outlined on construction documents.

1. Flow test data was not available due to water supply mains not currently installed and available near the site. The following information was utilized to determine pump and system sizing. This information is considered worse case scenario:

a. Static Pressure at Residual Fire Hydrant R: 1 psig.
b. Flow at Flow Fire Hydrant F: 1000 gpm.
c. Residual Pressure at Residual Fire Hydrant R: 1 psig.

C. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Sprinkler Occupancy Hazard Classifications:

a. Fire Pump Room: Ordinary Hazard, Group 2.
b. Flammable Storage: Extra Hazard, Group 1.
c. Building Service Areas: Ordinary Hazard, Group 1.
d. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
e. General Storage Areas: Ordinary Hazard, Group 1.
f. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
g. Public Areas and Classrooms: Light Hazard.

h. Lab Classrooms: Ordinary Hazard, Group II.

2. Minimum Density for Automatic-Sprinkler Piping Design:

   a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
   c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
   d. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq.ft. area.

3. Maximum Protection Area per Sprinkler: Per UL listing.
4. Maximum Protection Area per Sprinkler:

   a. Light Hazard: 225 sq. ft.
   b. Ordinary Hazard: 130 sq. ft.
   c. Extra Hazard: 100 sq. ft.
   d. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:

   a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
   b. Ordinary-Hazard Occupancies: 250 gpm for 60 minutes.
   c. Extra-Hazard Occupancies: 500 gpm for 90 minutes.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

   1. Wiring Diagrams: For power, signal, and control wiring.

C. Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria. Installing contractor shall submit shop drawing and calculations for review and approval.

D. Qualification Data: For qualified Installer and professional engineer.

E. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations.

F. Welding certificates.

G. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

H. Field quality-control reports.

I. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems. Base calculations on results of fire-hydrant flow test.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

A. Piping (sizes 2” or smaller) schedule 40, ASTM A-135

B. Piping (sizes 2-1/2” or larger) E.R.W. schedule 10 black steel, ASTM A-135, grade B.

C. Piping (sizes 2-1/2” or larger) seamless schedule 10 black steel, ASTM A-795, grade B.

D. Threadable thin wall or lightwall piping is not acceptable.

E. Flexible sprinkler piping is not acceptable.

F. Cast Iron Threaded Fittings: ANSI B16.4, class 125, standard pattern for threaded joints. Threads shall conform to ANSI B1.20.1.

G. Malleable Iron Fittings: ANSI B16.3, class 300, standard pattern for threaded joints. Threads shall conform to ANSI B1.20.1.

H. Steel Fittings: ASTM A-234 seamless or welded, for welded joints.

I. Grooved Mechanical Fittings: ASTM A-536, grade 65-45-12 ductile iron; ASTM A-47, grade 32510 malleable iron; or ASTM A-53, types F or types E or S, grade B fabrication steel fittings with grooves or shoulders designed to accept grooved end couplings.

J. Grooved Mechanical Couplings: Consist of ductile or malleable iron housing, a synthetic rubber gasket or a central cavity pressure-response design; with nuts, bolts, locking pin, locking toggle, or lugs to secure roll grooved pipe and fittings. Grooved mechanical couplings including gaskets used on dry pipe systems shall be listed for dry pipe service.

K. Cast Iron Flanged: ANSI B16.1, class 125, faced and drilled per American National Standard. Dimensions shall conform to WW-F-406.

2.3 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed and FM approved.
2. Minimum Pressure Rating: 175 psig.

B. Check Valves:

1. Screwed check: 2” and smaller 200 pounds screwed bronze Y-pattern swing check bronze disc, Nibco No. KT-403, Central model –Y.
2. Flanged check: 2-1/2” and larger, 175 pounds flanged body swing check, bronze set Nibco No. F-908-WS, Stockham No. G-939, Mueller No. A-2120-6.
3. Wafer Check: 4” and larger, 250 pounds cast iron body, elastomer seal and spring loaded clapper, Central Model B, Reliable C.
4. Grooved check: 2-1/2” and larger, 250 pounds cast iron body, elastomer seal and spring loaded clapper, Central Model 90, Grinnel Model F514.
5. Riser Check: 2-1/2” and larger, 250 pounds cast iron body, resilient elastomer seal, spring loaded clapper with trim. Central Model 90, Reliable Model G.

C. OS&Y Gate Valves:

1. 2” and smaller: 175 pounds threaded iron body, bronze trim solid wedge disc, Nibco No. T-104-0, Stockham No. B -133.
2. 2-1/2” and larger: 175 pounds flanged iron body, bronze trim solid wedge disc, Mueller No. A-2052-5, Nibco No. F-607-OTS, Stockham No. G634.

D. Indicating-Type Butterfly Valves:

1. Wafer: 2-1/2” and larger: 175 pounds, outside indicating, slow close type, with UL listed dual supervisory switches. Central Model – A, Grinnell Series 8000FP.
2. Grooved: 2-1/2” and larger: 175 pounds, outside indicating slow close type, grooved ends, UL listed dual supervisory switches. Central Model BVF, Grinnell Series 7700FP.

E. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing and "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig.

F. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Fire Protection Products, Inc.
d. FNW.
e. Kennedy Valve; a division of McWane, Inc.
f. Legend Valve.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Red-White Valve Corporation.
j. Stewart, M. A. and Sons Ltd.
k. Tyco Fire & Building Products LP.
l. Victaulic Company.

2.4 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing and "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Automatic Air Release Valve:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Tyco Fire & Building Products LP.

2. Standard: UL 2573.
3. Type: Manual or Automatic electrically supervised.
4. Components: Ball Valve, Single-pole, double-throw switch with normally closed contacts.
5. Design: Reduces trapped air in pressurized system. Install at highest point of system on main or highest portion of system. Do not obstruct sprinkler spray patterns. Locate on top of pipe. Electronic supervision is required to notify when valve is in other than fully open position.

C. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AFAC Inc.
b. Reliable Automatic Sprinkler Co., Inc.
c. Tyco Fire & Building Products LP.

2. Standard: UL 1726.
3. Pressure Rating: 175 psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.5 FIRE-DEPARTMENT CONNECTIONS

A. Free Standing-Type, Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Elkhart Brass Mfg. Company, Inc.
    b. Guardian Fire Equipment, Inc.
    c. Potter Roemer.
    d. Fire-End & Croker Corporation.

3. Standard: UL 405.
4. Type: Free Standing Type.
5. Pressure Rating: 175 psig minimum.
6. Body Material: Corrosion-resistant metal.
7. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
8. Caps: Brass, lugged type, with gasket and chain.
9. Escutcheon Plate: Rectangular, brass, wall type.
10. Outlet: With pipe threads.
11. Number of Inlets: Two.
12. Escutcheon Plate Marking: Similar to "AUTO SPKR."
13. Finish: Polished chrome plated.
14. Outlet Size: 2-1/2 inch.

2.6 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anvil International, Inc.
    b. Shurjoint Piping Products.
    c. Tyco Fire & Building Products LP.
    d. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175 psig.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AGF Manufacturing Inc.
   b. Triple R Specialty.
   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.
   e. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

2.7 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Refer to drawings for specifications.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Commercial Applications: UL 199.
2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes:

1. Refer to drawings for specifications.

E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Refer to drawings for specifications.
2. Sidewall Mounting: Refer to drawings for specifications.

F. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Shall match sprinkler head manufacturer.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.8 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Tyco Fire & Building Products LP.
b. Victaulic Company.
c. Viking Corporation.

2. Standard: UL 753.
3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 10-inch diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4.
8. Outlet: NPS 1 drain connection.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Vane.

2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

D. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell company.
b. Kennedy Valve; a division of McWane, Inc.
c. Potter Electric Signal Company.
d. System Sensor; a Honeywell company.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

2.9 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMETEK; U.S. Gauge Division.
2. Ashcroft, Inc.
3. Brecco Corporation.
4. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0 to 250 psig minimum.

E. Water System Piping Gage: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 SERVICE-ENTRANCE PIPING

A. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

J. Install alarm devices in piping systems.

K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

M. Install automatic air release valve at the highest point in the system.

N. Fill sprinkler system piping with water.

O. Install sleeves for piping penetrations of walls, ceilings, and floors.

P. Install sleeve seals for piping penetrations of concrete walls and slabs.

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 21 05 18 "Escutcheons for Fire-Suppression Piping."

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

I. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.5 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. For penetrations into cooler and freezer spaces, use rubber boots listed and provided by the sprinkler manufacturer.

3.6 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install free standing, fire-department connections.

B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.7 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.10 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Schedule 40, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3. All piping exposed to outside elements shall be galvanized matching requirements above.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 8, shall be one of the following:

1. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
2. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
3. All piping exposed to outside elements shall be galvanized matching requirements above.

3.11 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Refer to drawings for specifications.
2. Rooms with Suspended Ceilings: Refer to drawings for specifications.
3. Wall Mounting: Refer to drawings for specifications.
4. Spaces Subject to Freezing: Refer to drawings for specifications.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Refer to drawings for specifications.
2. Recessed Sprinklers: Refer to drawings for specifications.
3. Upright, Pendent, and Sidewall Sprinklers: Refer to drawings for specifications.

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SECTION 21 31 13
ELECTRIC-DRIVE, IN-LINE FIRE PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. In-line fire pumps.
2. Fire-pump accessories and specialties.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Comply with NFPA 20.

B. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig minimum unless higher pressure rating is indicated.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 GENERAL REQUIREMENTS FOR IN-LINE FIRE PUMPS

A. Description: Factory-assembled and -tested fire-pump and driver unit.

B. Base: Fabricated and attached to fire-pump and driver unit, with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.

C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

2.3 IN-LINE FIRE PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pentair Pump Group.

B. Pump:

1. Standard: UL 448, for in-line pumps for fire service.
2. Casing: Radially split case, cast iron, with ASME B16.1 pipe-flange connections.
3. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
4. Wear Rings: Replaceable bronze.
5. Shaft and Sleeve: Steel shaft with bronze sleeve.

a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.

6. Mounting: Pump and driver shaft is vertical, with motor above pump and pump on base. Motor and pump rotating assembly shall be removable from top without removing the pump casing from the piping.

C. Coupling: None or rigid.

D. Driver:

1. Standard: UL 1004A.
2. Type: Electric motor; NEMA MG 1, polyphase Design B.

E. Capacities and Characteristics:

1. Fire Protection Contractor shall provide a fire pump that shall provide 500 gpm @ 85 psi, 40 HP, 3 phase, 460V, 60Hz in accordance with NPFA 20. Calculations shall be based on current flow test data. The Fire Protection contractor shall provide a current flow test within (6) months of date of submission.

2.4 FIRE-PUMP ACCESSORIES AND SPECIALTIES

A. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.

B. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.

C. Relief Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BERMAD Control Valves.
b. CLA-VAL Automatic Control Valves.
c. Kunkle Valve.
d. OCV Control Valves.
e. WATTS.
f. Zurn Industries, LLC.

2. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.

D. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.

E. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.

2.5 GROUT

A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink and recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.

B. Equipment Mounting:

1. Install fire pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 03 30 00 "Cast-in-Place Concrete."

C. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.

D. Support piping and pumps separately, so weight of piping does not rest on pumps.

E. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Section 21 13 13 "Wet-Pipe Sprinkler Systems."

F. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in Section 21 13 13 "Wet-Pipe Sprinkler Systems."

G. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.

H. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.

I. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

3.2 ALIGNMENT

A. Align end-suction pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.

B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.

C. Align piping connections.

D. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.

3.3 CONNECTIONS

A. Comply with requirements for piping and valves specified in Section 21 13 13 "Wet-Pipe Sprinkler Systems." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps and equipment to allow service and maintenance.

C. Connect relief-valve discharge to drainage piping or point of discharge.

D. Connect flowmeter-system meters, sensors, and valves to tubing.

E. Connect fire pumps to their controllers.

3.4 IDENTIFICATION

A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

3.5 FIELD QUALITY CONTROL

A. Test each fire pump with its controller as a unit.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. After installing components, assemblies, and equipment, including controller, test for compliance with requirements.
2. Test according to NFPA 20 for acceptance and performance testing.
3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

E. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

END OF SECTION 21 31 13

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Division 22

Plumbing

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SECTION 22 01 00
GENERAL PLUMBING PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE OF DIVISION

A. Work shall include all materials, equipment and labor necessary for a complete and properly functioning plumbing installation in accordance with all applicable codes, and contract drawings and specifications. Work shall include all work specified in Division-22, Plumbing.

B. Pay for all required licenses, fees, inspections and permits.

1.3 RELATION TO OTHER WORK

A. Work Not in Division 22: Related work not included in this division consists of requirements given in the following as may be included in the contract documents:

1. Other divisions which may include work (such as concrete, steel, painting, ceiling systems, structure and other work) related to the work of Division 22.

B. Work of Division 22: Any or all sections of Division 22 may include a paragraph or paragraphs under the heading, "Relation to other Work". Where such a paragraph is indicated and work directly related to the section is listed or described, such work shall be considered as relating directly to the indicated section. Any related work (directly related or otherwise) which may be omitted by reference from the "Relation to Other Work" paragraph of such section(s), shall be provided as necessary and required whether or not such work is included by reference. Such listing or description of related work within a section is given only as a convenience to the Contractor; omission of other related sections or described work does not in any way exclude the provision of such work.

C. The Plumbing contractor shall coordinate with the controls vendor for all control related equipment that is provided by the controls vendor and installed by the Plumbing contractor.

1.4 CODES

A. Install all work in accordance with the latest edition of all applicable regulations and governing codes, including the regulations of the utility companies serving the project.

B. Where a conflict in code requirements occurs the more stringent requirement shall govern.

1.5 STANDARDS

A. All equipment and devices shall bear U.L. label, the label of an industry recognized approved testing agency or A.G.A. certification for said item of equipment or device.

B. All electrical devices must be U.L. approved.

1.6 DRAWINGS

A. Architectural and structural drawings take precedence over plumbing drawings with reference to the building construction. Plumbing drawings are diagrammatic and indicate the general arrangement and extent of work. Architectural drawings indicate more exactly the desired relationship between diffusers, registers, lighting fixtures, equipment, electric panels and devices, plumbing fixtures, and other items which remain exposed in the completed building. Exact locations and arrangement of materials and equipment shall be determined, with the acceptance of the Architect/Engineer, as work progresses to conform in the best possible manner with the surroundings and with the adjoining work of other trades. Where locations of equipment, devices or fixtures are controlled by architectural features, establish such locations by referring to dimensions on Architectural drawings and not by scaling drawings.

1.7 DISCREPANCIES

A. In case of differences between drawings and specifications, or where drawings and specifications are not clear or definitive, the more stringent requirement shall apply. Any such discrepancies shall be referred to Architect/Engineer for clarification and instructions.

1.8 ELECTRICAL PROVISIONS

A. Work of Division 22 shall include the electrical requirements which are indicated to be integral with plumbing work and which can be summarized to include (but not necessarily be limited to) the following:

1. Motors
2. Unless shown otherwise, motor starters are to be furnished by plumbing contractor, installed by electrical contractor.
3. In lieu of the plumbing contractor furnishing motor starters, the plumbing contractor can coordinate with the electrical contractor where the electrical contractor furnishes and installs a combination motor starter / disconnect switch.
4. Control switch, pilot lights, interlocks and similar devices.
5. Electrical heating coils and similar elements in plumbing equipment.
6. Electrical work specified in Division-22 for the HVAC control system.
7. Drip pans to protect electrical work.

B. Motors, Starters, Switches:

1. All motors 1HP and above associated with plumbing equipment that are not being provided with a variable frequency drive shall be provided with a motor starter.
2. For motors under 1HP that are required to be controlled shall be coordinated with the building automation system to ensure start / stop control is achieved. Provide all relays, wiring and devices as required to achieve desired control.

C. Drip Pans: Where possible, do not run plumbing piping directly above electrical (or electronic) equipment which is sensitive to moisture; otherwise provide drip pans under plumbing piping. Locate pan below piping and extend 6" on each side of piping and lengthwise 18" beyond equipment. Fabricate pans 2" deep, of reinforced sheet metal with rolled edges and soldered or welded seams; 20 gage copper, or 16 gage steel with 2 oz. zinc finish hot dipped after fabrication. Provide 3/4" copper drainage piping, properly discharged to a waste receptor.

1.9 ELECTRICAL/PLUMBING WORK

A. Definitions: Definitions for the purpose of Plumbing/electrical control and power coordination are as follows: (Note: The use of the words, "Provide", "furnish" and "install" are intended only for use in describing the coordination indicated by this paragraph and do not necessarily have the same definitions when used outside of the context of this paragraph.) Any items which do not fall within the scope of this paragraph shall be coordinated as individually specified.

1. "Furnish" means to procure an item and to deliver it to the project for installation.
2. "Install" means to determine (in coordination with others as necessary) the appropriate intended location of an item and to set and connect it in place.
3. "Provide" means to both furnish and install.
4. Power Circuit: Circuit which carries main electric power to apparatus to which the power circuit is connected.
5. Control Circuit: Circuit which carries electrical signals directing the performance of a controller, but which does not carry the main electric power. (See NEC, Section 430-71.) Such circuits shall also include those which serve a dual control and power function (e.g., a line voltage thermostat circuit which both activates and powers a small fan motor).
6. Controller: A device, or group of devices, which serves to govern, in some predetermined manner, electric power delivered to apparatus to which the controller is connected and includes any switch or device normally used to start and stop a motor. (See NEC, Article 100, Definitions, "Controller", and Section 430-81(a).)
7. Control Device: A device which reacts to an operating condition (pressure, temperature, flow, humidity, etc.) and which initiates transmission of an electrical control signal which causes operation of a controller or which causes operation of pressure switches, etc.
8. Auxiliary Control Device: A device (such as a low voltage control transformer, electric relay, etc.) which is located in a control circuit and which carries or responds to (but does not initiate) an electrical control signal initiated by a control device.

B. Work of Division-22 includes (but is not necessarily limited to):

1. Provide:

a. All controllers which are generally manufactured or shipped as integral with Division-22 equipment
b. All electric motors and other electrical power consuming equipment (such as electric air heating coils, electric boilers, electric hot water heaters, etc.) which are specified in Division 22.
c. All control circuits (including conduit and boxes) from the Division-26 panels to point of use including the necessary circuit breakers.
d. All other control circuits, including conduit and boxes.
e. All control connections to equipment.
f. All control connections to controllers, switches, motors and other plumbing systems electrical power consuming equipment (such as, electric boilers, electric hot water heaters, etc.).

g. Auxiliary control devices.
h. All control devices (thermostats, pressure switches, flow switches, humidistats, etc.) and make control circuit connections thereto.
i. Any and all pneumatic and electronic and electric control devices and electric or pneumatic connections thereto.

2. Furnish:

a. All controllers which are generally manufactured and/or shipped as separate but companion items to Division-22 equipment.

1.10 AUXILIARIES AND ACCESSORIES

A. Include all auxiliaries and accessories for complete and properly operating systems.

1.11 COORDINATION

A. Provide all required coordination and supervision where work of this division connects to or is affected by work of others.

1.12 PROVISIONS FOR OPENINGS

A. Provide all openings required for work performed under Division-22. Provide sleeves or other approved methods to allow passage of items installed under any Section of Division-22.

1.13 CLEANING AND PROTECTION

A. Equipment: All plumbing equipment provided shall be thoroughly cleaned of all dirt, oil, concrete, etc. Any dents, scratches or other visible blemishes shall be corrected, and the appearance of the equipment made "like new" and to the satisfaction of the Architect/Engineer.

B. Upon completion, and before final acceptance of the work, all debris, rubbish, leftover materials, tools and equipment shall be removed from the site.

C. Protection of Work Until Final Acceptance: Protect all materials and equipment from damage, entrance of dirt and construction debris from the time of installation until final acceptance. Any materials and equipment which are damaged shall be repaired to "as new" condition or replaced at the direction of the Architect/Engineer. Where factory finishes occur and damage is minor, finishes may be touched up. If, in the opinion of the Architect/Engineer the damage is excessive, factory finish shall be replaced to "new" condition.

1.14 SHOP DRAWINGS

A. Submit shop drawings for all items, services and systems included in the project.

B. Shop drawings shall clearly show the following:

1. Technical and descriptive data in detail equal to or greater than the data given in the item specification. Indicate all characteristics, special modifications and features. Where

performance and characteristic data is shown on the drawings or specified, submitted data shall be provided in a degree which is both quantitatively and qualitatively equal to that specified and shown so that comparison can be made. Present data in detail equal to or greater than that given in item specification and include all weights, deflections, speeds, velocities, pressure drops, operating temperatures, operating curves, temperature ranges, sound ratings, dimensions, sizes, manufacturers' names, model numbers, types of material used, operating pressures, full load amperages, starting amperages, fouling factors, capacities, set points, chemical compositions, certifications and endorsements, operating voltages, thicknesses, gauges and all other related information as applicable to particular item.

2. Exceptions to or deviations from the contract documents. Should Architect/Engineer accept any items having such deviations which are not clearly brought to Architect/Engineer's attention, in writing, on item submittal, then Contractor is responsible for correction of such deviations regardless of when such deviations are discovered.

C. Additional Requirements: See specific sections of the Specifications for any additional requirements.

1.15 SHOP DRAWINGS TECHNICAL INFORMATION SUBMITTALS

A. All submittals are to be submitted electronically in the form of PDF. Electronic submittal file names must be formatted with the specification section number followed by the title of the specification section. One PDF file shall be provided for each specification section that requires submittals to be provided.

B. A cover page shall have adequate space for Contractor, Subcontractor and Engineer review stamps and indicate the following minimum data:

1. Project Name
2. Project Address
3. Contractor Name
4. Subcontractor Name
5. Specification Section Number
6. Specification Section Name
7. Submittal Date

C. All shop drawings and equipment submittals shall be submitted complete based on specification division. Partial submittals of each specification section will not be accepted.

D. All submittals shall have been reviewed for compliance by the Contractor and associated subcontractor prior to submission to the Engineer. A stamp bearing the name of the reviewer and date review was completed shall be on the cover page of the submittal.

E. Submittal data shall be logically grouped based on equipment tags or like material. For submittals that contain data on multiple materials or equipment, it shall be clearly noted by equipment tag or applicable material.

F. Manufacturer’s data indicating multiple options or choices shall be clearly noted as to what is applicable to the material and equipment being provided. Information not applicable should be struck through or extracted.

1.16 SHOP DRAWINGS FOR PIPING SYSTEMS

A. Shop drawings for piping systems shall be performed by the installing subcontractors. Shop drawings shall show all required maintenance and operational clearances required. Title drawings shall include identification of project and names of Architect, Engineer, Contractor, subcontractor and/or supplier, date, be numbered sequentially and shall indicate the following:

1. Architectural and structural backgrounds with room names and numbers, etc., including but not limited to plans, sections, elevations, details, etc.

a. Fabrication and Erection dimensions.
b. Arrangements and sectional views.
c. Necessary details, including complete information for making connections with other work.
d. Kinds of materials and finishes.
e. Descriptive names of equipment.
f. Modifications and options to standard equipment required by the contract.

B. Shop drawings shall be submitted in electronic PDF format and shall bear the review stamp from the plumbing subcontractor and general contractor / CM that it has been reviewed for compliance.

C. See specific sections of specifications for further requirements.

1.17 ELECTRONIC FILES

A. Any requests for electronic files shall be preceded by processing the required electronic file release form and submitting to the Engineer for authorization. Request for electronic files should be submitted through the Contractor for submission to the Architect / Engineer.

1.18 OPERATING INSTRUCTIONS

A. Submit for checking a specific set of written operating instructions on each item which requires instructions to operate. After acceptance, insert information in each Technical Information Brochure. Refer also to other sections which may describe operating instructions.

1.19 MAINTENANCE INFORMATION

A. Submit for acceptance Maintenance Information consisting of manufacturer's printed instruction and parts lists for each major item of equipment. After acceptance, insert information in each Technical Information Brochure. Refer also to other sections which may describe maintenance.

1.20 SYSTEM GUARANTEE

A. The work required under Division-22 shall include a one-year guarantee. This guarantee shall be by the Contractor to the Owner to replace for the Owner any defective workmanship, equipment, or material which has been furnished under this Contract at no cost to the Owner for a period of one year from the date of acceptance of the System. This guarantee shall also

include reasonable adjustments of the system required for proper operation during the guarantee period.

1.21 MATERIALS AND EQUIPMENT

A. Each bidder represents that his bid is based upon the materials and equipment described in this division of the specifications.

1. Submittal shall include the name of the material or equipment for which it is to be substituted, substituted equipment model numbers, drawings, cuts, performance and test data and any other data or information necessary for the Architect/Engineer to determine that the equipment meets all specification and requirements. If the Architect/Engineer accepts any proposed substitutions, such acceptance will be set forth in writing.
2. Substituted equipment with all accessories installed or optional equipment where permitted and accepted, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether accepted or not, shall be replaced at the Contractor's expense. Any modifications of related systems of this or other trades as a result of substitutions shall be made at the Contractor's expense, and Contractor shall so state in his written request for substitution.

B. Acceptable Manufacturers: Materials and Equipment specified in these contract documents are accepted only in regard to general performance and quality. It shall be the Contractor's responsibility to ensure that acceptable materials and equipment meet or exceed the efficiencies, capacities, electrical characteristics, performance and quality of the equipment herein specified. Acceptable equipment must also generally conform, without extensive modification of related systems to the accessories, weights, space and maintenance requirements, etc., of the specified equipment. Any modification to related systems of this or other trades shall be made at the Contractor's expense and the Contractor shall be responsible for coordination between trades. Any difference in capacity, efficiency, electrical characteristics, weights or quality of product, etc., between specified materials and equipment and acceptable alternates shall be submitted to the Architect/Engineer for acceptance within 30 days of Notice to Proceed.

PART 2 - PRODUCTS

2.1 Section part not applicable.

PART 3 - EXECUTION

3.1 Section part not applicable.

END OF SECTION 22 01 00

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SECTION 22 05 23
VALVES, COCKS AND SPECIALTIES FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install valves, cocks and specialties as indicated on drawings or specified herein.

B. Valves, cocks and specialties may not be indicated in every instance on the drawings, but whether or not shown, all valves, cocks and check valves necessary to the proper operation of the system shall be furnished and installed by subcontractor in an approved manner and location. Pressure ratings given for valves are steam working pressure. Valves shall have rising stems except in locations where space is limited; in these locations non-rising stem valves of equal material and pressure class will be accepted.

C. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 WATER MAIN VALVES

A. Water main valves are to be AWWA approved, gate valve, double disc, iron body, bronze trim, non-rising stem, flanged end, with 2" square wrench nut. Valve boxes are to be cast iron adjustable type for top flush with ground surface. Furnish a box for each underground valve shown on drawings.

Valves	Valve Boxes
Mueller No. A2380-6	Alabama Pipe Co. E2602
Stockham Fig. G-745	James B. Clow F2450
Crane No. 462	Mueller H10360

2.2 BALL VALVES

A. 2-1/2- inches and smaller: Threaded or soldered ends, port area equal to or greater than connecting pipe diameter, class 125, two piece bronze body, bronze ball, bronze stem, teflon seat and seals. Acceptable manufacturers: Crane, Hammond, Jamesbury, Nibco, Stockham, Walworth, and Apollo.

2.3 LAWN FAUCETS

A. Lawn Faucets to be rough nickel plate, lock shield compression stop with removable handle, solid flange, female connection, with 3/4 inch male threaded hose end with anti-syphon device.

	1/2" Inlet	3/4" Inlet
Mueller Co.	H-8297	H-8297
Hammond	1000	1000
Chicago Faucet	293	387

,OR.

B. Provide integral or separate stop for lawn faucet.

,OR.

C. Lawn Faucets shall be as scheduled on the drawings.

2.4 CHECK VALVES (SWING)

A. Check valves 3" and smaller shall have a pressure rating of not less than 200 psi threaded pattern and 125 psi solder pattern, wye pattern swing check with rough brass body, finished gland nut and regrinding bronze disc.

B. Check valves larger than 3" shall be flanged pattern, 125 psi iron body swing check with renewable brass seat, disc and trim. Check valves on primary heating hot water or chilled water piping system shall be 200 psi WP brass or ferrosteel body swing check valves, with renewable brass seat, disc and trim.

	Flanged Pattern	
	125 psi	200 psi
Crane	373	39E
Powell	559	576
Walworth	M-928F	M-970F
Lunkenheimer	1790	323
Stockham	G-931	---

2.5 CHECK VALVES (WAFER)

A. Check valves 3" and larger flanged pattern shall have a pressure rating of 125 psi, globe type body, semm. steel body, stainless steel spring, bronze disc and bronze seat ring.

Williams-Hager	Figure 636
APCO	Series 600
Mueller	Nos. 105, 107, 109 and 113
Metraflex	Series 900

B. Check valves on primary hot water piping systems shall be 200 psi, globe type body, semi steel body, stainless steel spring, bronze disc and bronze seat.

2.6 COCKS

A. Provide tight shut off balancing cocks at locations indicated on drawings.

B. Cocks 2" and smaller, square head bronze cocks 125 psi class with check.

Crane 254
Powell 955
Walworth 554
Lunkenheimer 454,
or approved equal

C. Cocks over 2", lubricated plug valves with semi-steel body 175 psi class.

Screwed 2" and 3"	Flanged 4" and over
Powell F 2200	Powell F 2201
Walworth 1700	Walworth 1700F
ACF R 1430	ACF R 1431

or approved equivalent

D. Lubricated plug cocks over 6" shall have a geared or worm drive operator.

E. Lubricated plug cocks may be used in lieu of globe or gate valves on heating hot water or chilled water steel piping systems to facilitate installation of insulation. All 6" or smaller chilled water piping valves located above finished ceilings (unless located over drip pan), or below ceiling in a finished area of the building shall be lubricated plug cocks. Provide handle or operator for each valve.

2.7 BUTTERFLY VALVES

A. Butterfly valves shall be used in lieu of gate valves or throttling valves when indicated on the drawings.

1. Design working pressure and temperature 150 psig and 180°F.
2. Materials of construction:

a. Body: Malleable or ductile iron
b. Disc: Aluminum bronze
c. Stem: 416 stainless steel
d. Bushings: Bronze
e. Seat: Compound 230 Buna N or as per manufacturer's recommendation for specific service.
f. Handle: Lever lock through 10" size, if valve is to be used for throttling service, provide infinite adjustment throttle plate.

B. Valves used for the isolation of equipment or for future connections shall have flanged ends or flange unions to permit removal of equipment and/or piping with the valve remaining in service.

C. Acceptable manufacturers are Keystone, Center Line or Demco.

2.8 BACK FLOW PREVENTER (REDUCED PRESSURE)

A. 3/4" to 4" size; ASSE Std. 1013, AWWA Std. C-506; unit shall have all bronze construction, stainless steel internal parts, test cocks and suitable for 175 psi supply water pressure. Unit shall be furnished with factory mounted bronze inlet strainer, union and non-rising stem gate valves (on inlet and outlet). Watts Series 900 Beeco or approved equal.

B. 4" to 6" size; ASSE Std. 1013, AWWA Std. C-506; unit shall have iron body construction, epoxy coated internal water way, stainless steel internal parts, test cocks and stainless steel bolts. Unit shall be furnished with inlet strainer and non-rising stem gate valves (on inlet and outlet). Watts Series 900 Beeco or approved equal.

2.9 BACK FLOW PREVENTER (DOUBLE CHECK VALVE)

A. 3/4" to 2"; ASSE Std 1015, AWWA Std. C-506; unit shall have bronze body, stainless steel internal parts, test cocks and rubber seating check valves. Unit shall be furnished with factory mounted bronze inlet strainer, union, and non-rising stem gate valves (on inlet or outlet). Watts Series 700 Beeco, or approved equal.

B. 2-1/2" and 3"; ASSE Std. 1015, AWWA Std. C-506; unit shall have iron body, stainless steel internal parts, test cocks, and rubber seating check valves. Unit shall be furnished with flanged ends, factory mounted inlet strainer, union, stainless steel bolts and non-rising stem gate valves (on inlet and outlet). Watts Series 700 Beeco or approved equal.

2.10 DIELECTRIC UNIONS

A. Epco Sales, Inc., 3204 Sackett Avenue, Cleveland, Ohio; Capitol Manufacturing & Supply Company, Columbus; Patrol Valve Company, Cleveland, Ohio, or approved equal.

2.11 FLEXIBLE METAL HOSE

A. American Brass Co., Mason Industries, Chicago Metal Hose Co., or approved equal, 300 psig WP design flexible metal hose constructed of brass with brass wire braid covering.

2.12 FLEXIBLE PLASTIC PIPE JOINTS

A. Resist-O-Flex Co., Mercer Rubber Co., La Favorite Co., or approved equal, multiple bellows, guides, and restraining bolts or blocking. Joints shall be rated at 150 psig and 220°F continuous service.

2.13 STEEL PIPING SYSTEM STRAINERS

A. Malleable or cast iron, 125 psig working pressure. Free area of strainer - not less than 300 per cent cross sectional area of pipe. Strainer mesh, perforation size, and pattern as follows:

Pipe Size	Pattern	Mesh or Perforation Diameter
to 2 in.	threaded wye	20 mesh
2 to 4 in.	threaded wye	0.045 inch dia.
5 to 10 in.	flanged wye	0.125 inch dia.
12 in. up	flanged basket	0.125 inch dia.

2.14 COPPER PIPING SYSTEM STRAINERS

A. Copper piping system strainers solder pattern with removable bolted flange on strainer leg. Strainer 40 mesh bronze screen, with free area of screen at least 3 times cross sectional area of pipe.

2.15 ACCESS PANELS

A. Access panels (Milcor) Inland-Ryerson Construction Products Co., (Boico) Birmingham Ornamental Iron Co., or approved equal. Steel panels and frames shall be furnished with prime coat of rust inhibitor enamel. See plans for sizes (12 x 12) min.). Access panel styles as follows:

	Milco	Boico
Fire rated	1-1/2 hr. B. Label	1-1/2 hr. B. Label

2.16 SAFETY VALVES

A. Safety Valves to be Manning, Maxwell & Moore, Watts Regulator, or Bell & Gossett Co., ASME rated as shown on the drawings and/or required by applicable codes.

B. Refrigerant Safety Valves in accordance with USASI Code for refrigeration apparatus, and pipe discharge outside building.

C. Protect water heaters with Watts, Beaton Cadwell or McDonnell Miller, combination automatic temperature and pressure relief valves (with manual lift lever). Relief capacity shall exceed input energy at 125 psig pressure and 210^{o}F temperature.

2.17 AUTOMATIC AIR VENTS (AAV)

A. Automatic Air Vents to be equal to:

(150 psig W.P)	(75 psig W.P)
Metraflex MV-15	Maid-O-Mist 7
Crane Co. 976	Bell & Gossett 7
Sarco 13W	Hoffman 79
Armstrong 1AV	

2.18 MANUAL AIR VENTS (MAV)

A. Manual air vents shall be brass manual cock equal to Crane 700 series.

2.19 WATER HAMMER ARRESTERS

A. Water hammer arresters (shock stops) shall be equal to those manufactured by Josam Manufacturing Company, Watts, Wade, Inc., MIFAB or Jay R. Smith Manufacturing Company.

PART 3 - EXECUTION

3.1 GENERAL

A. Install valves and cocks in horizontal piping with the valve stem in the vertical upright position.

B. Install valves and cocks to provide adequate clearance to permit easy operation of the valve hand wheel and permit servicing of the valve packing.

*

C. Provide blow down valve on 1-1/2" and larger strainers (except refrigerant piping). Use valve not less than 1/2 strainer blow down outlet size.

3.2 ACCESS PANELS

A. Furnish adequate number of properly sized access panels (12" x 12" minimum size) to adequately service and maintain systems installed under each section of specifications.

B. Access panels shall be installed and painted under other divisions of these specifications. Exact panel location shall be designated by the subcontractor performing the work of this Section.

C. Access panels are not required in exposed grid or other types of readily removable ceilings.

D. Access panels shall not compromise the fire rating of the wall.

3.3 SAFETY VALVES

A. Safety valves to have valve spindle enclosure with gland seal to minimize leakage and manual lift lever to check discharge required. Cut discharge pipe from safety valve on a 45 degree angle, pipe to floor and direct toward or into floor drain (unless noted otherwise on the drawings).

3.4 AUTOMATIC AIR VENTS

A. Install automatic air vents with inlet isolation cock at locations indicated on drawings and at high points of hot and chilled water piping systems. Pipe vent discharge to drain pan, plumbing trap or to outside of building.

3.5 WATER HAMMER ARRESTERS

A. Install water hammer arresters (shock stops) at the locations indicated on the plans and all branch lines serving quick closing valves and in accordance with size and placement recommendations given in Plumbing and Drainage Institute Standard PDI-WH201.

3.6 BACKFLOW PREVENTERS

A. Water service back flow preventers shall be installed above grade and in such a manner to prevent the discharge relief opening from becoming submerged by ground water. Provide suitable protection to prevent assembly from freezing.

END OF SECTION 22 05 23

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SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Brimar Industries, Inc.
    c. Carlton Industries, LP.
    d. Champion America.
    e. Craftmark Pipe Markers.
    f. emedco.
    g. Kolbi Pipe Marker Co.
    h. LEM Products Inc.
    i. Marking Services, Inc.
    j. Seton Identification Products.

2. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: Yellow.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Brady Corporation.
   b. Brimar Industries, Inc.
   c. Carlton Industries, LP.
   d. Champion America.
   e. Craftmark Pipe Markers.
   f. emedco.
   g. Kolbi Pipe Marker Co.
   h. LEM Products Inc.
   i. Marking Services, Inc.
   j. Seton Identification Products.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: Yellow.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark Pipe Markers.
6. emedco.
7. LEM Products Inc.

8. Marking Sevices Inc.
9. National Marker Company.
10. Seton Identification Products.
11. Stranco, Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: Black.

D. Background Color: Yellow.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
3. Brimar Industries, Inc.
4. Carlton Industries, LP.
5. Champion America.
6. Craftmark Pipe Markers.
7. emedco.
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Sevices Inc.
11. Seton Identification Products.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

PART 3 - EXECUTION

3.1 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

C. Any shut off valves located within ceiling shall have highly visible location markers on walls or ceiling tiles.

3.2 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Architectural drawings and/or specifications.

B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Low-Pressure Compressed Air Piping:

   a. Background: Safety blue.
   b. Letter Colors: White.

2. Domestic Water Piping

   a. Background: Safety green.
   b. Letter Colors: White.

3. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Safety black.
   b. Letter Color: White.

END OF SECTION 22 05 53

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SECTION 22 07 00
INSULATION FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification Sections, apply to work of this section.

1.2 SCOPE

A. Above grade domestic hot water supply and recirculating piping.

B. Below grade domestic hot water supply and recirculating piping.

C. Above grade waste lines and trap from ice machines and waste lines receiving condensate from air conditioning units to a point of connection to a soil line receiving waste from 4 or more plumbing fixtures.

D. Interior storm water piping.

E. Above grade domestic cold water piping in vented attic, vented ceiling spaces and vented soffits with 3/4" fiberglass and all service jacket.

F. Above grade exterior domestic cold water piping.

G. Handicap lavatory exposed hot water and waste piping.

H. Above grade fire protection piping in vented attic, vented ceiling spaces and vented soffits with 3/4" fiberglass and all service jacket.

I. Above grade domestic chilled water piping.

J. Below grade domestic chilled water piping.

K. Domestic water chilled evaporator, chilled water compression or expansion tank; and other cold surfaces with operating temperatures of less than 70 degrees F.

L. Domestic chilled water pumps.

M. Above grade water piping exposed in unheated areas.

N. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-22 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials listed in subsequent paragraphs of this specification are those used as basis of design; alternate manufacturer's equivalent projects as listed herein will be accepted. The insulation contractor shall verify materials and comply with requirements of NFPA 90, with regard to a flame spread rating of 25 or less and; a smoke developed/fuel contributed value of less than 50.

2.2 MATERIALS

A. Insulation and accessory materials to be as manufactured by the listed manufacturers or approved equal:

1. Calcium Silicate: Owens Corning "Kaylo", Manville "Thermo-12".
2. Fiberglass: Owens Corning, Knauf, CertainTeed, or Manville.
3. Foamed Plastic Insulation: Armstrong "Armaflex", U.S. Rubber "Ensolex", Gustin Bacon "Ultra-Foam", Owens Corning "O-C" Halstead Industrial Products, or approved equal.
4. Cellular Glass: Fed. Spec. HH-I-551a.
5. Extruded Polyethylene Insulation: Nomaco Inc. "Thermacell, Sentinel Energy Savings Products Division of Packaging Energy Groups, Inc., "Senflex" or approved equal.
6. Insulating Finish Cement: JM No. 301, BH Improved Super Powerhouse Cement, The Ruberoid Co., No. 412, or approved equal.
7. Mastics, Sealers and Adhesives:

	Benjamin Foster	Insulcoustic	Childers	J-M
Cellular glass bedding mastic	30-45	40-10	CP-70	
General purpose mastic	35-00 Series Vi AC Mastic		CP-10	375
Vapor barrier sealant (indoor)	30-35	IC-501	CP-30	
Adhesive	85-20		CP-89	
Fire retardant sealer (outdoor)	60-35	IC-531		
Foamed Plastic & Adhesive				57
Extruded Poly-ethylene	Therma-Cel 950 Adhesive			

8. Pipe Jacketing and Valve Covers (Ultra Violet Resistant): Zeston PVC, CEEL-Tite, Proto Corp. (Lo Smoke), or approved equal.
9. Metal Jacketing and Fitting Cover: Aluminum 0.016 gage (minimum) smooth or corrugated, Childers Products Co., General Aluminum Supply Co. (Gasco), Alcorjac by Insulcoustic Co., or approved equal.
10. Molded Fiberglass Fitting Insulation: Molded Acoustical Products, Inc., West Easton, PA, 18042 or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Insulation is not to be installed until the piping systems have been checked and found free of all leaks. Surfaces shall be clean and dry before attempting to apply insulation. A professional insulator with adequate experience and ability shall install insulation.

B. Provide hanger or pipe support shields of 16 gage (minimum) galvanized steel over the insulation. Shield shall extend halfway up the pipe insulation cover and at least 6" on each side of the hanger. Securely fasten shield with pipe straps at each end. Insulate pipe anchors adequately to prevent moisture condensation problems.

C. Insulation installed in exposed locations such as water heater rooms, equipment rooms, air handling unit rooms, all exterior above grade areas, kitchens, laundries, power houses, utility buildings, energy building or similarly identified locations where the insulation would be subject to physical damage shall be covered with metal jacketing. Elbows may be covered with fire rated and ozone resistant (for exterior locations) PVC covers in lieu of metal jacket.

3.2 WARM OR HOT SURFACES

A. Insulate interior warm or hot surfaces with an operating temperature of over 120 degrees F and less than 400 degrees.

B. These surfaces include hot water storage heater.

C. Insulate with 1-1/2" thick calcium silicate blocks, securely wired on and covered with poultry wire. Apply a finish coat of 1/2' insulating finish cement over the poultry wire. Trowel the exterior smooth.

D. Insulate hot surfaces operating at over 100 degrees F temperature with 3/4" V-rib spacing lath and 1-1/2" molded 85% magnesia or calcium silicate blocks wired on over the spacing lath. Apply poultry wire over the magnesia blocks and give a 1/2" coat of insulating finish cement. Trowel the exterior smooth.

3.3 EMERGENCY GENERATOR MUFFLER AND EXHAUST PIPING

A. Shall be insulated with two 1-1/2" layers of calcium silicate block insulation. All joints shall be staggered and the blocks shall be installed with corrosive resistance stainless steel tie wires. The insulation shall be finished with a skim coat of Johns-Manville hydraulic setting insulation cement and covered with a layer or Underwriters grade cloth. The cloth shall be sized with Foster's 30-36 fire retardant coating or equal.

3.4 COLD SURFACES

A. Cold surfaces with operating temperatures below 70 degrees F to be insulated with 1" thickness foamed plastic or extruded polyethylene insulation. Surfaces include, but not limited to, domestic water chiller, domestic chilled water air separator, domestic chilled water expansion tank, domestic chilled water pump, and refrigerant suction line intercooler. The foamed plastic sheets shall be applied over a heavy coating of Johns-Manville #57 adhesive. The insulation shall be finished with a heavy coat of white aerotube finish.

3.5 CONDENSATE PIPING FROM ICE MACHINES

A. Insulate condensate piping and waste lines from ice machines with foamed plastic insulation or extruded polyethylene, one-half inch thickness.

B. Mitre cut insulation to fit the pipe fittings. Use approved cement to seal all joints, seams, and ends in the insulation.

3.6 HORIZONTAL RAIN WATER PIPING

A. Shall be insulated with 1/2" thickness fiberglass pipe insulation. Prior to installing with insulation the pressure release paper shall be removed from the jacket laps. Pipe insulation shall be secured in place by applying pressure to the pressure sensitive closure system. Elbows shall be insulated with fiberglass inserted into 25/50 rated PVC (Aluminum) fitting covers.

B. Insulation shall begin at the base of roof drain body and include piping elbows at change of directions from vertical to horizontal.

3.7 HORIZONTAL WASTE PIPING RECEIVING AIR-CONDITIONING CONDENSATE

A. Shall be insulated with 1" thickness AP-T fiberglass pipe insulation. Prior to installing with insulation, the pressure release paper shall be removed from the jacket laps. The insulation shall be secured in place by applying pressure to the pressure sensitive closure system. All fittings shall be insulated with pipe insulation segments and finished with Foster's 30-35 vapor barrier coating or equal, reinforced with white open weave glass fabric.

3.8 DOMESTIC CHILLED WATER PIPING

A. Insulate domestic chilled water piping as described in these paragraphs with cellular glass. (Cellular glass with a factory applied glassfab jacket is acceptable.) Mitre cut insulation and carefully fit to the pipe fittings. Piping 6 inch and smaller, use 1-1/2" thickness insulation; piping over 6 inch diameter, use 2" thickness insulation. All cellular glass shall be shop bore-coated with Keen's cement prior to shipment to the job site. All pipe insulation joints shall be buttered with Foster's GPM 3500 or equal. The insulation sections shall be wired in place with 16 gauge copper or stainless steel wires spaced approximately 9" on center. Valves and fittings shall be insulated with prefabricated or pre-formed sections of cellular glass insulation and finished the same as adjacent piping.

B. Finish cellular glass insulation in concealed locations by applying a heavy coat of Foster's GPM 3500 vapor barrier sealant a to the exterior surface of the cellular glass. Embed a layer of open weave glass fabric cloth in this sealant overlapping seams at least 2". Apply a finish coat of Foster's GPM 3500 and finish as smooth as possible. Note: Two coats of sealer will be required where factory applied glassfab jacket is used.

C. Finish cellular glass in exposed interior locations such as air handling unit equipment rooms, boiler rooms, and chiller room as follows:

1. Straight runs of 2" piping and larger - cover with 0.016" thickness smooth aluminum weatherproof jacket with factory applied integral vapor barrier. Piping 2" and smaller - 0.010" thickness aluminum jacket with integral vapor barrier. Seal joints to preserve integrity of vapor barrier. Fasten jacket with 1/2" wide aluminum bands on not over 12" centers. Elbows, tees, reducers, valves and other special fittings - use prefab jacket.

3.9 UNDERGROUND PIPING

A. Insulate all underground domestic hot and chilled water piping with 1-1/2" thickness cellular glass preformed split sectioned pipe insulation.

B. Mitre cut insulation and carefully fit to the pipe fittings. All cellular glass to be shop bore-coated with Keen's cement prior to shipment to the job site. Apply cellular glass bedding mastic to all edges of the cellular glass insulation to fill any voids between joints in the insulation.

C. Wire the Cellular glass in place with stainless steel or copper wire 9" on centers. Expansion joints in the insulation with 1/4" clearance shall be made 10' on centers. The expansion joints shall be filled with asphalt impregnated felt and covered with the jacket.

D. Apply a heavy coat of vapor barrier sealant to outside of the cellular glass and embed a layer of open mesh glass fabric cloth into the mastic; carefully apply the cloth smoothly and overlap all transverse and longitudinal joints at least 2". Apply a second heavy and final coat of mastic over the cloth and finish to a reasonably smooth surface.

E. All legs of underground expansion loops and expansion ells shall be additionally covered with 2" thickness fiberglass 7-1/4 pounds per cubic foot density fiberglass pipe insulation applied under the cellular glass and under the glass fabric.

3.10 ABOVE GROUND DOMESTIC COLD WATER

A. Shall be insulated with ASJ fiberglass pipe insulation. Prior to installing the insulation, the pressure release paper shall be removed from the jacket laps. The insulation shall be secured in place by applying pressure to the pressure sensitive closure system. All fittings shall be insulated with molded fiberglass pipe insulation segments and finished with Foster's 30-35 vapor barrier coating or equal, reinforced with a layer of white open weave glass fabric.

B. Branch runouts up to 2" shall have 1/2" thickness insulation.

3.11 ABOVE GROUND DOMESTIC HOT WATER AND DOMESTIC HOT WATER RECIRCULATION PIPING

A. Shall be insulated with ASJ fiberglass pipe insulation. Prior to installing the insulation, the pressure release paper shall be removed from the jacket laps. The insulation shall be secured in place by applying pressure to the pressure sensitive closure system. All fittings shall be insulated with molded fiberglass pipe insulation segments and finished with Foster's 30-35 vapor barrier coating or equal, reinforced with a layer of white open weave glass fabric.

B. Pipe sizes 1-1/4" and smaller shall have 1" thickness insulation.

C. Pipe sizes 1-1/2" to 4” shall have 1-1/2" thickness insulation.

3.12 HANDICAP LAVATORY EXPOSED HOT WATER AND WASTE PIPING

A. Shall be insulated with foamed plastic insulation or extruded polyethylene, one-half inch thickness.

B. Mitre cut insulation to fit the pipe, fittings and stops.

C. Use approved cement to seal all joints, seams, and end in the insulation.

END OF SECTION 22 07 00

SECTION 22 11 13
WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SUMMARY

A. This Section specifies the water distribution piping system, including potable cold, hot, and recirculated hot water piping, fittings, and specialties within the building to a point 5 feet outside the building.

1.3 DEFINITIONS

A. Water Distribution Piping: A pipe within the building or on the premises which conveys water from the water service pipe or meter to the points of usage.

B. Water Service Piping: The pipe from the water main or other source of potable water supply to the water distributing system of the building served.

1.4 QUALITY ASSURANCE

A. Codes and Standards:

1. ASTM A 120-84 Specifications for pipe.
2. ASTM B 88-83A Specifications for seamless copper water tube.
3. ANSI B16.4 Fittings, Flanges, and Valves.
4. ANSI B16.22 Fittings, Flanges, and Valves.
5. ASSE 1003 and 1003-1 - Performance Requirements for Water Pressure Reducing Valves.
6. AWWA Cll0-82 Standard for Fittings, Flanges, and Valves.
7. AWWA C600 - Standard for Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances.
8. AWWA C110-82 Standard for Gaskets.
9. AWWA C601 - Standard for Disinfecting Water Mains.
10. PDI WH-201 - Water Hammer Arresters.
11. Plumbing Code Compliance: Comply with applicable portions of BOCA Basic National Plumbing Code.
12. ASME Compliance: Fabricate and stamp pressure - Standards of these Organizations, the more stringent regulations shall govern.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store pipe in a manner to prevent sagging and bending.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad. Concrete, reinforcement, and form work requirements are specified in Division 03.

B. Coordinate the installation of pipe sleeves for foundation wall penetrations.

1.7 SPARE PARTS

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer uniformity: Conform with the requirements specified in Basic Mechanical Requirements, under "Product Options."

B. Manufacturer: Subject to compliance with requirements, provide water distribution piping products from one of the following:

1. Balance Cocks:

   a. Bell & Gossett ITT; Fluid Handling Div.
   b. Taco, Inc.

2. Pressure Regulating Valves:

   a. Cash (A.W.) Valve Mfg. Corp.
   b. Spence Engineering Co., Inc.
   c. Watts Regulator Co.

3. Water Meters:

   a. Badger Meter, Inc.
   b. Rockwell Intl.; Municipal & Utility Div.

4. Relief Valves:

   a. Cash (A.W.) Valve Mfg. Corp.
   b. Watts Regulator Co.

5. Water Hammer Arresters:

   a. Amtrol, Inc.
   b. Tyler Pipe; Sub. of Tyler Corp.
   c. Watts

2.2 PIPE AND FITTINGS

A. Pipe Within Building (except below slab):

1. Pipe Sizes 2" and Smaller: Copper tubing. Conform to ASTM B88, Type L, hard temper, copper tube; ANSI B16.22 streamlined pattern wrought-copper fittings, with soldered joints using 95-5 tin-antimony solder.
2. Pipe Sizes Larger than 2": Copper K. Conform to ASTM B88; with pipe couplings and fittings.

B. Pipes Inside and Outside Building, Below Ground:

1. PVC plastic water pipe. Conform to AWWA C900, for Class 100, Polyvinyl chloride (PVC) water pipe;/ AWWA Cll0, for Class 100, cast-iron or ductile-iron fittings; mechanical joints.

2.3 VALVES

A. Gate Valves: Refer to Section 22 05 23.

B. Balance Cocks:

1. Threaded Ends 2" and Smaller: Class 125, bronze body, bronze plug, screw driver operated, straight or angle pattern.
2. Soldered Ends 2" and Smaller: Class 125, bronze body, bronze plug, screw driver operated, straight or angle pattern.

C. Piping Specialties:

1. Water Hammer Arresters: Bellows type, with stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201.
2. Basket Strainers: Cast-iron body, 125 psi flanges, bolted type or yoke type cover; with removable non-corrosive perforated strainer basket having 1/8" perforations and lift-out handle.
3. Flexible connectors: Stainless steel bellows with a woven flexible bronze wire reinforcing protective jacket; rated for 150 psig water working pressure, 250 degrees F operating temperature and suitable for up to maximum 3/4" misalignment. Connectors shall be a minimum of 12" long and have threaded or flanged ends; sweat ends are not acceptable.
4. Hose Bibbs: Bronze body, renewable composition disc, tee handle, 3/4" NPT inlet, 3/4" hose outlet.
5. Sill Faucets: Bronze body, with renewable composition disc, wheel handle, 3/4" solder inlet, 3/4" hose outlet.
6. Recessed Non-Freeze Wall Hydrants: Cast-bronze box, with chrome plated face, tee handle key, vacuum breaker, hinged locking cover, 3/4" inlet, and hose outlet. Bronze casing shall be length to suit wall thickness.
7. Pressure Regulating Valves: Single seated, direct operated type; having bronze body with integral strainer, and complying with requirements of ASSE Standard 1003. Select proper size for maximum flow rate and inlet and outlet pressures indicated.

D. Relief Valves:

1. Provide proper size for relief valve, in accordance with ASME Boiler and Pressure Vessel Codes, for indicated capacity of the appliance for which installed.

2. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 180 degrees F, and pressure relief at 100 psi.

2.4 WATER METER

A. Water meter: Compound type, conforming to AWWA Standards. Size meter and arrange piping and specialties to comply with utility company requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all water distribution piping may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in requirements plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 JOINING PIPES AND FITTINGS

A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1.

3.3 PIPING INSTALLATION

A. Refer to the separate Division 22 section: Basic Piping Materials and Methods, for general piping installation instructions.

B. PVC piping, fittings and other PVC materials shall not be installed in air conditioning plenums or equipment rooms used as air conditioning plenums.

C. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement on, pump sizing, and other design considerations. So far as practical, install piping as indicated.

D. Install piping with 1/32" per foot (1/4 percent) downward slope towards drain point.

3.4 SERVICE ENTRANCE

A. Extend water distribution piping to connect to water service piping, of size and in location indicated for service entrance to building.

B. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation.

C. Install shutoff valve at service entrance inside building; complete with strainer, pressure gage, and test tee with valve.

D. Ductile-Iron Pipe: Install in accordance with AWWA C-60.

3.5 ROUGH-IN FOR WATER METER

A. Install rough-in piping and specialties for water meter installation in accordance with utility company's instructions and requirements.

3.6 INSTALLATION OF VALVES

A. Installation requirements for general duty valves are specified in a separate section of Division 22.

B. Sectional Valves: Install sectional valves on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated. For sectional valves 2" and smaller, use gate or ball valves; for sectional valves 2-1/2" and larger, use gate or butterfly valves.

C. Shutoff Valves: Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated. For shutoff valves 2" and smaller, use gate or ball valve; for shutoff valves 2-1/2" and larger, use gate or butterfly valves.

3.7 INSTALLATION OF PIPING SPECIALTIES

A. Install backflow preventers at each connection to mechanical equipment and systems, and in compliance with the plumbing code and authority having jurisdiction. Locate in same room as equipment being connected. Pipe relief outlet without valves, to nearest floor drain.

B. Install pressure regulating valves with inlet and outlet shutoff valves, and balance cock bypass. Install pressure gage on valve outlet.

3.8 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Plumbing Code.

B. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated. Provide connection. For connections 2-1/2" and larger, use flanges instead of unions.

3.9 FIELD QUALITY CONTROL

A. Inspections:

1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.

2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform test specified below in the presence of the plumbing official.

    a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
    b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing official.
    c. Reinspection: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange System Test:

3. Test for leaks and defects all new water distribution piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
4. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing that has been covered or concealed before it has been tested and approved.
5. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for a period of 4 hours. Leaks and loss in test pressure constitute defects which must be repaired.
6. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

3.10 ADJUSTING AND CLEANING

A. Cleaning and Disinfecting:

1. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use.
2. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction, or in case a method is not prescribed by that authority, the procedure described in either AWWA C601, or AWWA D105, or as described below:

    a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
    b. Fill the system or part thereof, with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system, or part thereof, and allow to stand for 24 hours.
    c. Drain the system, or part thereof, of the previous solution, and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.
    d. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming for the system.
    e. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

B. Reports:

1. Prepare reports for all purging and disinfecting activities.

END OF SECTION 22 11 13

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SECTION 22 11 16
PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. The work pertaining to this Division occurs within the confines of the building line, and within a boundary outside of the building line for a distance of five (5) feet, measured normal to the building line, or as indicated on the drawings.

B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 PIPING SPECIALTIES

A. Where it is desirable or necessary to support the pipe hangers to concrete, inserts shall be placed in the forms by the Mechanical Contractor prior to the time concrete is poured.

B. Lead tamp-ins may be used when installed in a concrete or masonry wall or other like vertical surface to support a vertical hanger. Lead tamp-ins will not be permitted to support hangers to the underside of concrete slab.

C. For parallel runs of above ground suspended piping, an acceptable trapeze-type hanger may be used. Provide permanent, non-conductive type wrapping between copper pipe and steel trapeze hangers.

D. Pipes passing through walls, floors shall have sleeves of the same materials as the pipe. Sleeves shall allow insulated pipes to pass without changing the insulation thickness. Clearance around sleeves shall be packed with glass fiber after completion of pipe work.

Sleeves in all floor slabs except slabs on grade shall have pipe sleeves extended 1 inch above finish floor to prevent water from running through sleeves to area below. Make watertight, caulk with sealant around each sleeve.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The contractor shall furnish all labor, materials, *including gases* equipment and instruments required to conduct tests of piping systems. Tests shall be as herein called for.

B. PVC piping, fittings and other PVC materials shall not be installed in air conditioning plenums or equipment rooms used as air conditioning plenums.

C. Tests shall be conducted and the inspection of the piping shall be made in the presence of the Architect and/or Engineers.

D. Material and/or joints found defective shall be replaced and/or corrected and additional tests shall be conducted after correction of work.

3.2 PIPE SIZING, DRAWINGS AND SPECIFICATIONS

A. It is intended that work covered by these specifications and drawings include everything requisite and necessary to make the various systems complete and operative, irrespective of whether or not every item is specifically provided for. Any omission of direct reference herein to any essential item shall not excuse contractor from complying with the above intent.

B. Figured dimensions supercede scaled ones. Contractor shall take no advantage of, and shall promptly call the Owner's Representative's attention to any error, omission or inconsistency in specifications and drawings.

C. Special attention is directed to requirements that equipment and materials stated in specifications and/or indicated on drawings shall be furnished, except if otherwise noted, completely installed, adjusted and left in safe and satisfactory operating condition. Accessories, appliances and connections necessary for operation of equipment shall be provided to satisfaction of the Owner's Representative.

D. Materials, apparatus or equipment specified or otherwise provided for on drawings, addenda, or change orders issued subsequent to award of contract shall be same brand, type, quality and character originally specified unless otherwise provided.

E. Layout of equipment, accessories, specialties and suspended, concealed or exposed piping systems are diagrammatic unless dimensioned. In preparing shop drawings, contractor shall check project conditions before installing work. If there are any interferences or conflicts, they shall be called to attention of the Owner's Representative immediately for clarification.

F. The drawings indicate required size and points of termination of pipes and ducts and suggest proper routes to conform to structure, avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the work of this contractor to make the installation in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further obstruction or cost to the Owner.

G. Shop drawings shall be furnished by this contractor, indicating all changes to meet space requirements, code requirements and as necessary to resolve all space conflicts.

H. It is intended that all apparatus be located symmetrical with architectural elements, and shall be installed at exact height and locations as shown on the architectural drawings. Refer to architectural details in completing and correlating work.

I. The contractor shall fully inform himself regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnished and installed under the contract, prior to submitting his bid. He shall exercise due and particular caution to determine that all parts of his work are made quickly and easily accessible.

J. The contractor shall carefully examine any existing conditions, existing piping and ducts and premises and compare the drawing with the existing conditions, prior to submitting his bid.

K. It cannot be too strongly emphasized that, except for work specifically excluded herein, every system shall be turned over to Owner installed completed, with components, ready for normal operation.

L. In addition to work shown on mechanical drawings, see Architectural Drawings for existing work to be removed, relocated and/or modified. Modify existing systems by rerouting for systems to remain or remove the abandoned systems as required to accommodate new general construction, plumbing, electrical and mechanical work.

M. Pipe sizes shall be minimum as allowed by local codes or as shown on the drawings, whichever is larger.

END OF SECTION 22 11 16

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SECTION 22 11 19
DOMESTIC COLD & HOT WATER SUPPLY PIPING & HOT WATER CIRCULATING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. The work pertaining to this Division occurs within the confines of the building line, and within a boundary outside of the building line for a distance of five (5) feet, measured normal to the building line, or as indicated on the drawings.

B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide valves and specialties as specified under additional Sections of this Specification.

2.2 PIPE

A. The following schedule covers materials unless otherwise specified under a particular System Section.

1. Copper K, ASTM B88.
2. Copper tube, Type L, hard drawn, ASTM B 88.
3. Brass pipe or tube, chrome plated.

2.3 FITTINGS

A. Steel Pipe: Malleable iron 150 lb. banded, galvanized to match pipe.

B. Copper Tube: Wrought or cast brass solder joint.

C. The 'T' drill extruded fitting method may not be used.

D. Service material shall be brass compression fittings-angle ball cocks, ball corporations, etc. Flared fittings are acceptable under controlled conditions.

2.4 PIPE JOINTS

A. Joints in copper piping shall be made with tin-antimony solder (95-5) and non-acid flux. Contractor shall furnish manufacturers literature documenting that the lead content (trace quantities) are within the guidelines of the local codes having jurisdiction as well as the Safe Drinking Water Act Amendment (SDWAA).

B. Joints in threaded piping shall be made with teflon tape or non hardening pipe compound (seal-tite).

PART 3 - EXECUTION

3.1 GENERAL

A. The design drawings are generally diagrammatic. They do not show every bend, off-set, elbow or other fitting which may be required in the piping for installation in the space allotted. Careful coordination of the work is necessary to avoid conflicts.

B. Run all water lines parallel or perpendicular to building lines.

C. For piping requiring insulation, lay out and carefully install piping with sufficient clearances to permit proper application of the insulation. If the piping is such that a neat insulation job cannot be obtained with reasonable effort, the piping subcontractor shall relocate piping.

D. Separate underground water piping and building sewer with undisturbed or compacted earth at least 10' horizontally if installed at the same level or lower than the sewer. Where water piping is closer than 10' to a sewer, place the bottom of the water pipe at least 18" above the top of the sewer, or the sewer shall be encased in a concrete envelope as required by the Department of Health & Rehabilitative Services (State of Florida).

E. Minimum cover for exterior underground piping is three feet over insulation or conduit unless otherwise noted on plans. Carefully excavate trench to smooth finished surface; if cut is too deep, backfill with clean earth and hand tamp to compact bottom. Make depression at joints to receive flanges, collars, and couplings. Provide continuous support for pipe or conduit. Backfill to be clean earth, free of rocks and debris completely enveloping pipe or conduit on both sides and top to a minimum thickness of 6". Carefully hand tamp backfill in 6" layers until 24" has been deposited over pipe or conduit.

F. Place color coded 6" wide 0.004" thickness polyethylene printed plastic identification tape directly above all underground piping systems approximately 12" below finished grade. Tapes shall be continuously printed with "CAUTION" in large bold letters. Printed second line

with type of service below. Yellow tape is to be used for water, (Print type of water on tape; i.e., domestic cold water.)

3.2 HANGERS AND SUPPORTS

A. Vertical Piping shall be supported at its base and no greater than every story height.

B. Horizontal Piping (Suspended) shall be supported at not more than eight (8) foot intervals. Supports shall be adequate to maintain alignment and prevent sagging.

C. Supports shall be connected to the building structure not from other equipment, ducts or conduits.

3.3 JOINTING PIPE

A. All pipe lines shall be correctly aligned before joints are made.

B. Squarely cut pipe and properly ream to remove all constriction and burrs before making up the joints.

C. Threaded Pipe: Ream all pipe after cutting and before threading. Use non-hardening pipe compound or tape on male threads only at each joint and tighten joint to leave not more than 3 threads exposed.

D. Copper Tube: Ream all pipe after cutting squarely, clean outside of tube ends and inside of fittings and tin end to be soldered. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

E. Provide nipples of same material and weight as pipe used. Provide extra strong nipples when length of unthreaded part of standard weight nipple is less than 1-1/2".

F. Run water supply main to point indicated on plans.

3.4 WATER HAMMER ARRESTERS

A. Water hammer arresters (shock stops) shall be installed at the locations on the plans and all branch lines serving quick closing valves and in accordance with PDI Standard WH-201. Provide access panels so located to permit ease of service.

3.5 VALVES

A. Provide valves to isolate each riser, and branch line. See also Section 220523 for requirements.

3.6 REDUCERS

A. Screwed bushings are prohibited, except where available space prevents use of reducing couplings. Pipe reductions on horizontal, hot water piping shall be made with eccentric reducers. Top of hot water piping shall be flat for venting.

3.7 TESTS

A. Apply a water pressure test to all parts of the water supply system before the piping is concealed and before the fixtures and equipment are connected. Use a hydrostatic pressure of not less than 100 psig or 150% of system operating pressure, applied to the system for a period of four hours. There shall be no leaks at any point in the system at this pressure.

B. Leave concealed work uncovered until required tests have been completed, but if necessary, make tests on portions of the work and those portions of the work may be concealed after being inspected and approved. Make repairs of defects that are discovered as a result of inspection or tests with new materials. Caulking, welding or other such sealing methods of screwed joints, cracks or holes will not be accepted. Repeat tests after defects have been eliminated.

C. Complete all field testing prior to insulation, wrapping and/or backfill.

3.8 STERILIZATION

A. As soon as the water piping has been thoroughly flushed out, sterilize the lines by introducing into them a solution of calcium hypochlorite or chloride of lime. Open and close all valves while system is being chlorinated. After the sterilizing agent has been applied for 24 hours, test for residual chlorine at the ends of the lines. If less than 10 parts per million is indicated, repeat the process. When tests show at least 10 parts per million of residual chlorine, flush out the system until all traces of the chemical used are removed. Make necessary connections to sterilized piping.

3.9 PIPE PROTECTIONS

A. Paint all uninsulated piping underground with two coats of asphaltic paint. (Manual wiping is not acceptable)

B. Wrap pipe that touches metal or is exposed to masonry with a layer of 6 mil polylene film or 15 lb. felt.

C. Spirally wrap all pipe lines embedded in concrete with two layers of 30 lb. felt.

D. Coat all exposed threads on galvanized steel pipe after assembly with two coats of zinc chromate. Remove pipe thread lubricants prior to applying paint.

END OF SECTION 22 11 19

SECTION 22 11 23
DOMESTIC WATER BOOSTER PUMP

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install booster pump system including all valves, fittings and by pass.

B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

1.5 MANUFACTURERS

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products complying with the requirements of this Section and the installation requirements of the plans are acceptable.

PART 2 - PRODUCTS

2.1 PUMPS

A. Horizontally mounted close coupled, bronze fitted, end suction centrifugal pumps with mechanical seals and bronze wear rings.

2.2 MOTORS

A. Motors shall be NEMA standard, ball bearing, industrial quality and furnished with drip-proof enclosures.

2.3 HYDRO-PNEUMATIC TANK

A. Internal reservoir type, 170 gallon, ASME 200 psi tank. Supplied with pressure switch and circuit to shut off lead pump during low flow conditions.

2.4 VALVES AND PIPING

A. Suction and discharge headers shall be fabricated of flanged schedule 40 seamless pipe, hot dip galvanized after fabrication. System shall be furnished with full lug style butterfly valves, Clayton 90-01 PRV'S, non-slam wafer check valves, liquid filled gauges, control tubing with shut-off cocks and Metraflex flexible connectors at each header.

2.5 CONTROLS

A. The control panel shall be a NEMA 3R UL labeled panel, mounted and wired for additive pump sequence, continuous lead pump, 3 pump manual alteration, supplied with low suction pressure safety shut- down, pilot lights, HOA switches, control transformer, disconnect, fuse blocks and pump sequencing controls. Control panel shall sequence pumps via pressure transducer with led readout of actual system pressure. Each pump shall be controlled by a digital, solid state control board with all pressure and minimum run time delays field adjustable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install booster pump system as indicated on the drawings, in accordance with manufacturer's installation instructions and in compliance with applicable codes.

B. Set booster pump system level and plum on a 4" high concrete pad and orientated so controls and devices needing service and maintenance have adequate access.

C. Booster pump system shall be prepiped and prewired to single point service connections from the manufacturer.

D. Connection to domestic water piping system with dielectric unions, isolation shutoff valves and a by pass.

E. Complete instructions covering installation and operation of the booster pump system shall be provided in booklet form. All components shall be identified, in exploded views, by individual part number. Complete start-up service shall be performed by the manufacturer’s representative.

F. Subsequent service and stocking of spare parts shall be available from a local authorized dealer.

END OF SECTION 22 11 23

SECTION 22 13 16
SANITARY SEWER, STORM WATER AND SANITARY VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. The work pertaining to this Division occurs within the confines of the building line, and within a boundary outside of the building line for a distance of five (5) feet, measured normal to the building line, or as indicated on the drawings.

B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 MATERIAL

A. The following schedule covers materials unless otherwise specified under a particular System Section.

2.2 PIPE

A. Cast-iron soil pipe service weight, centrifugally cast, ANSI A112.5.1. 2" Through 15" size, bell and spigot joint.

B. Cast-iron soil pipe service weight, centrifugally cast, ANSI A112.5.1. 1-1/2" through 10" size, "non-hub" joint.

C. Reinforced concrete pipe (RCP) 12" through 144" bell and spigot pattern with O-ring rubber gaskets, ASTM C76.

D. Copper type DWV.

E. Brass pipe or tube, chrome plated.

F. PVC Type DWV, ASTM D2665-78. 1-1/2" through 6" size.

2.3 PIPING APPLICATIONS

A. For above ground soil waste and vent piping, use any of the following materials:

1. Cast iron soil pipe service weight “NO-HUB” joints.
2. Copper type DWV.
3. Brass pipe or tube, chrome plated. This shall be provided for all above ground p-traps. PVC p-traps are not acceptable.
4. PVC type DWV, ASTM D2665-78.

B. For below ground soil waste and vent piping, use any of the following materials:

1. Grease line: Cast iron soil pipe service weight bell and spigot. PVC shall not be acceptable.
2. Sanitary waste:

    a. Cast iron soil pipe service weight bell and spigot.
    b. PVC type DWV, ASTM D2665-78. (Note: In HVAC plenums, PVC piping shall not be installed.)

3. Storm (Refer to size limitation in Section 2.2):

    a. Cast iron soil pipe service weight bell and spigot.
    b. PVC type DWV, ASTM D2665-78.
    c. Reinforced concrete pipe.

2.4 FITTINGS

A. Cast-Iron Soil Pipe:

1. Underground: Provide fittings of same weight and manufacture as pipe in which installed. Joints shall be bell and spigot push-on type neoprene gasket or "NO HUB" type conforming to CIPI Standard 301 unless noted otherwise on drawings.
2. Above ground and in buildings: "NO-HUB" type conforming to CIPI Standard 301 unless noted otherwise on the drawings.

B. Threaded Drainage Pipe: Cast-iron, recessed.

C. Copper DWV: Cast or wrought solder joint DWV drainage fittings.

D. PVC Type DWV: ASTM D-2665, NSF Seal of Approval, Solvent-cement joint.

2.5 PIPE JOINTS

A. Bell and spigot type joint shall be made with push-on compression type, neoprene gasket conforming to ASTM A-74.

B. No-hub type joints shall be constructed of 24 gage type 304 stainless steel, with gasket guides, type 304 stainless steel screw clamp, and matching neoprene (ASTM C-564) gasket that shall interlock with housing.

C. Joints in copper piping shall be made with tin-antimony solder (95-5) silver solder and non-acid flux.

D. Joints in threaded piping shall be made with teflon tape or non hardening pipe compound (Seal-tite).

2.6 VENT FLASHING

A. Furnish 4 lb. lead flashing, material as recommended by roofing system manufacturer, or copper pitch pans for all vents through the roof. Type of flashing used shall be compatible with piping material.

2.7 IDENTIFICATION

A. Below grade piping identification and warning tape shall be 0.004 inch thick polyethylene, printed with a continuous two line message. Tapes used for non magnetic piping materials shall have a metallic core. Acceptable manufacturer is Seton Name Plate Corporation or approved equal.

B. Above ground piping identification tape shall conform to ANSI and ASME A13.1 2007.

PART 3 - EXECUTION

3.1 GENERAL

A. The design drawings are generally diagrammatic. They do not show every bend, off-set, elbow or other fitting which may be required in the piping for installation in the space allotted. Careful coordination of the work is necessary to avoid conflicts.

B. PVC piping, fittings and other PVC materials shall not be installed in air conditioning plenums or equipment rooms used as air conditioning plenums.

C. Joints and connections shall be made permanent and watertight.

D. Run piping to sewer connection point outside of building or as indicated on drawings.

E. Install 3" and larger horizontal soil and waste piping to 1/8" per foot slope. Piping 2" and smaller shall be installed at a slope of 1/4" per foot. Run horizontal vent lines to a minimum grade back to stacks and vertical vent lines as direct and free from bends as possible.

F. For piping requiring insulation, lay out and carefully install piping with sufficient clearances to permit proper application of the insulation. If the piping is such that a neat insulation job cannot be obtained with reasonable effort, the piping subcontractor shall relocate piping.

G. Separate underground water piping and building sewer with undisturbed or compacted earth at least 10' horizontally if installed at the same level or lower than the sewer. Where water piping is closer than 10' to a sewer, place the bottom of the water pipe at least 18" above the

top of the sewer, or the sewer shall be encased in a concrete envelope as required by the Department of Health & Rehabilitative Services (State of Florida).

H. Minimum cover for exterior underground piping is three feet over conduit unless otherwise noted on plans. Carefully excavate trench to smooth finished surface; if cut is too deep, backfill with clean earth and hand tamp to compact bottom. Make depression at joints to receive bells, collars, and couplings. Provide continuous support for pipe or conduit. Backfill to be clean earth, free of rocks and debris completely enveloping pipe or conduit on both sides and top to a minimum thickness of 6". Carefully hand tamp backfill in 6" layers until 18" has been deposited over pipe or conduit.

I. Place color coded 6" wide 0.004" thickness polyethylene printed plastic identification tape directly above all underground piping systems approximately 12" below finished grade. Tapes shall be continuously printed with "CAUTION" in large bold letters. Printed second line with type of service below. Red tape is to be used for sewer, (Print type of water on tape; i.e., storm water.)

J. Where condensate piping is indicated, piping shall be extended to the nearest catch basin/yard drain. A cast iron back water valve shall be provided with epoxy-coated steel access housing.

3.2 HANGERS AND SUPPORTS

A. Vertical Piping shall be supported at its base and no greater than every story height, not to exceed 20 foot intervals.

B. Horizontal Piping (Suspended) shall be supported at each bend; at not more than five (5) foot intervals; except that pipe exceeding five (5) feet in length may be supported at not more than ten (10) foot intervals. Supports shall be adequate to maintain alignment and prevent sagging and shall be made directly behind the bell or coupling, where possible, not near the center of the pipe.

C. Supports shall be connected to the building structure not from other equipment, ducts or conduits.

D. Horizontal pipe and fittings six inches and larger shall be suitably braced to prevent horizontal movement. This should be done at every branch opening or change of direction by the use of braces, blocks, rodding or other suitable method, to prevent movement.

E. Where components are suspended in excess of eighteen inches by means of non-rigid hangers, they should be suitably braced against movement horizontally, often called sway bracing.

3.3 LINE AND GRADE

A. Install gravity lines at uniform grade to low point after field verification of low point invert.

B. Run piping straight, plumb and grade in the direction indicated on the drawings.

3.4 JOINTING PIPE

A. All pipe lines shall be correctly aligned before joints are made.

B. Squarely cut pipe and properly ream to remove all constriction and burrs before making up the joints.

C. Threaded Pipe: Ream all pipe after cutting and before threading. Use non-hardening pipe compound on male threads only at each joint and tighten joint to leave not more than 3 threads exposed.

D. Copper Tube: Ream all pipe after cutting squarely, clean outside of tube ends and inside of fittings and tin end to be soldered. Apply non-acid solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

E. Joining "NO-HUB" cast iron soil pipe and fittings shall be in accordance with recommended practices described by the coupling manufacturers.

F. Provide nipples of same material and weight as pipe used. Provide extra strong nipples when length of unthreaded part of standard weight nipple is less than 1-1/2".

G. Provide reducing fittings (reducing bushings shall not be used) where changes in pipe sizes occur.

H. Provide dielectric unions or flanges between copper and steel piping and between brassware and steel. Do not use steel and copper piping in the same system without such isolation.

3.5 PIPE PROTECTION

A. Paint all uninsulated piping underground (except cast iron) with two coats of asphaltic paint (Manual wiping is not acceptable).

B. Wrap soil pipe that touches metal or is exposed to masonry with a layer of 6 mil polylene film or 15 lb. roofing felt.

C. Spirally wrap all pipe lines embedded in concrete with two layers of 30 lb. roofing felt.

D. Paint all PVC piping exposed to outdoors with UV resistant paint. Paint color to match adjacent building elements.

3.6 TESTS

A. A water test shall be applied to the sanitary and storm drainage systems either in its entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening and the system filled with water to point of overflow. If the system is tested in sections, each opening shall be tightly plugged except the highest openings of the section under test, and each section shall be filled with water, but no section shall be tested with less than 10 ft. head of water. In testing successive sections at least the upper 10 ft of the next preceding section shall be tested, so that no joint or pipe in the building (except the uppermost 10 ft of the system) shall have been submitted to a test of less than a 10 ft head of water. The water shall be kept in the system, or in the portion under test, for at least 30 minutes before inspection starts; the system shall then be tight at all points.

B. An air test shall be made by attaching an air compressor or testing apparatus to any suitable opening and after closing all other inlets and outlets to the system, forcing air into the system until there is a uniform gauge pressure of 5 psi or sufficient to balance a column of mercury

ten inches in height. This pressure shall be held without introduction of additional air for a period of at least 30 minutes.

C. Complete all field testing prior to insulation, wrapping and/or backfill.

3.7 VENT FLASHING

A. Extend lead type flashing 12" beyond pipe in all directions and carry to top of pipe with at least 2" return inside of pipe.

B. Install PVC pipe flashing in accordance with flashing manufacturer's recommendation.

C. Flashing for PVC piping shall be installed in accordance with manufacturer's instructions.

D. Install flashing materials as required by roofing system manufacturer's details and methods.

END OF SECTION 22 13 16

SECTION 22 13 17
CLEANOUTS AND CLEANOUT ACCESS COVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

B. Alternates may be or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.2 SCOPE

A. Furnish and install cleanouts as shown on drawing or specified herein.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleanouts and cleanout access covers shall be of the type and materials as scheduled on the drawings.

B. Provide all necessary bolts and appurtenances to effect a complete installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all cleanouts and cleanout access covers in accordance with the manufacturer’s instructions.

B. Exterior cleanouts below grade shall be extended to finish grade. Pour a concrete pad 18" x 18" x 6" thick around cleanout; slope top down approximately 2" from cleanout to edge of pad so that edge of pad is flush with grade.

C. Cleanouts shall be of the same nominal size as the pipes to which they are connected up to 4" in diameter; and not less than 4" for larger pipes.

D. Cleanouts shall be provided at not more than 50 feet apart in horizontal drainage lines of 4" nominal diameter, and at not more than 75 feet apart for larger diameter pipe.

E. At change in direction: Cleanouts shall be provided at each change of direction of the building drain when the angle of change is 90 degrees.

F. At base of stacks: Cleanouts shall be provided at or near the base of each vertical stack.

G. Direction of cleanout: All cleanouts shall be installed so that the cleanout opens in a direction opposite to the flow of the drainage line, or at a right angle to the line.

H. Concealed cleanouts in wall shall be provided with removable access panel.

I. Where access cleanout boxes or covers are installed in the floor, the top surface shall be scoriated and the cover secured, but removable when necessary. Polished brass. Install carpet type covers in carpeted areas.

END OF SECTION 22 13 17

SECTION 22 13 19
FLOOR DRAINS AND SHOWER DRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install floor drains and shower drains including strainers and trap primers.

B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 DRAINS

A. Drains shall be of the type and materials as scheduled on the drawings.

B. Provide all necessary bolts, clamping rings and appurtenances to effect a complete installation.

C. The strainer size shall be as recommended by the manufacturer unless otherwise indicated on the drawings. The strainers shall be nickel alloy or polished brass. Provide tapped boss and trap primer floor drains as indicated on the drawings.

2.2 TRAP PRIMERS

A. Provide for all floor drains.

B. Units shall be cast bronze, with removable top cover, threaded or sweat pattern, and integral vacuum breaker.

C. Acceptable manufacturers are: Wade, Josam, Smith, MIFAB and Watts.

2.3 SHOWER PANS

A. Shower pans shall be constructed from lead. Sheet lead shall be 6-pound weight, except that 4-pound sheet lead may be used for each pan installed without joints or seams other than corner seams.

B. Shower pans shall be constructed of polyethylene concealed chlorinated waterproofing membrane; nominal 0.040-inch thickness, equal to chloraloy. All joints and/or seams shall be welded tight with CPE (non plasticized chlorinated polyethylene) solvent bonding liquid or xylene.

PART 3 - EXECUTION

3.1 DRAINS

A. Install all drains in accordance with the manufacturer's instructions.

3.2 TRAP PRIMERS

A. Trap primer outlet should extend vertically a minimum of 12" before a change in direction to horizontal is made. The horizontal line to the trap primer connection shall be installed sloping to the trap it serves. Provide a minimum size of 12" x 12" stainless steel access cover for each trap primer.

3.3 SHOWER PANS

A. The floor of each individual shower, the shower area portion of combination shower and drying room, and the entire shower and drying room where the two are not separated by curbing or partition shall be made watertight with a shower pan fabricated in place. The shower pan material shall be cut to size and shape of the area indicated, in one piece to the maximum extent practicable, allowing not less than eight inches for turn-up on walls or partitions, and shall be folded over the curb with an approximate return of one-fourth of curb height. The upstands shall be placed behind any wall or partition finish. Shower pans shall be clamped to drain as specified herein. After installation of the pan and the finished floor, the drain shall be temporarily plugged below the weep holes. The floor area shall be flooded with water to a minimum depth of 4 inches at curb areas and 1 inch without curbs for a period of 24 hours. Any drop in the water level during the test, except for evaporation, shall be reason for rejection, repair and retest.

B. When a shower pan of required size cannot be furnished in one piece, the separate metal pieces shall be joined with a flat-lock seam and soldered or burned. The corners shall be folded tight, not cut, and the corner seam shall be soldered or burned. Pans, including upstands, shall be coated inside and outside with one brush coat of roofing asphalt. Asphalt shall be applied evenly at not less than one gallon per 50 square feet. The joining surfaces of metal pan and drain shall be given a brush coat of roofing asphalt after the pan is connected to the drain.

C. When a shower pan of required size cannot be furnished in one piece, the separate pieces shall be joined with solvent bonding liquid. The corners shall be folded tight, not cut, and the corner seam shall be sealed.

END OF SECTION 22 13 19

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SECTION 22 13 21
DRAINAGE AND VENT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SUMMARY

A. This Section specifies building sanitary and vent piping systems.

B. Related Sections:

1. Separate sections in Division-02 specify sanitary sewage systems, and trenching and backfilling.
2. Separate sections in Division-07 specify flashing and sheet metal and joint sealers.
3. Division-23 Basic Mechanical Requirements section applies to the work of this section.
4. Separate sections of Division-22 specify Basic Piping Materials and Methods, Hangers and Supports, Expansion Compensation, piping system requirements, pipe insulation, and plumbing equipment.

1.3 DEFINITIONS

A. Drainage System: Includes all the piping within a public or private premises which conveys sewage or other liquid wastes to a point of disposal. It does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.

B. Vent System: A pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and back pressure.

1.4 QUALITY ASSURANCE

A. Codes and Standards:

1. Plumbing Code Compliance: Comply with applicable portions of the Florida Building Code.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate the installation of flashing and roof penetrations.

B. Coordinate flashing materials installation of roofing, waterproofing, and adjoining substrate work.

C. Coordinate with installation of sanitary and storm sewer systems as necessary to interface building drains with drainage piping systems.

D. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer Uniformity: Conform with the requirements specified in Basic Mechanical Requirements.

B. Drainage Piping Specialties, including expansion joints, drains, trap primers, and vandal-proof vent caps:

1. Josam Mfg. Co.
2. Watts
3. Wade Division, Tyler Pipe

2.2 ABOVE GROUND DRAINAGE AND VENT PIPE AND FITTINGS

A. Hubless cast-iron soil pipe: Conform to CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310.

B. Rain water leader piping above grade may be PVC meeting AWWA C900 Class 100. Joints shall be mechanical using elastomeric gaskets. Use of PVC in return air plenums (i.e., office area) and through fire rated assemblies will not be permitted.

2.3 UNDERGROUND BUILDING DRAIN PIPE AND FITTINGS

A. Pipe sizes 15" and smaller: Cast-iron soil pipe. Conform to ASTM A74, for Extra-Heavy weight, hub-and-spigot soil pipe and fittings, with neoprene compression gasket joints conforming to ASTM C564. Pipe and fittings shall have a heavy coating of coal tar varnish or asphaltum on both inside and outside surfaces.

2.4 DRAINAGE PIPING SPECIALTIES

A. Trap Primers: Bronze body valve with automatic vacuum breaker, with ½" connections matching piping system, complying with ASSE 1018.

B. Expansion Joints: Cast-iron body with adjustable bronze sleeve, bronze bolts with wing nuts.

C. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

D. Floor Cleanouts: Cast-iron body and frame, with clean-out plug and adjustable round top as follows:

1. Nickel-Bronze Top: Manufacturer's standard cast unit with a standard non-slip scored or abrasive finish.
2. Cast-iron Top: Manufacturer's standard cast unit with a standard non-slip scored or abrasive finish.

E. Wall Cleanouts: Cast-iron body adaptable to pipe with cast-bronze or brass cleanout plug; stainless steel cover including screws.

F. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide under-deck clamp and sleeve length as required.

G. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.

H. Floor Drains:

1. Floor drain type designations and sizes are indicated on Drawings; See fixture schedules.

I. Roof Drain:

1. Roof drain type designations and sizes are indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Verify all existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.

C. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.

D. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.

E. Do not proceed until unsatisfactory conditions have been corrected.

3.2 JOINING PIPES AND FITTINGS

A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1.

B. Cast-Iron Soil Pipe: Make lead and oakum caulked joints, compression joints, and hubless joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.

3.3 INSTALLATION

A. Refer to the separate Division-22 section: Basic Piping Materials and Methods, for general piping installation instructions.

B. Install supports and anchors in accordance with Division-23 Basic Mechanical Materials and Methods section "Supports and Anchors".

C. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.

D. Make changes in direction for drainage and vent piping using appropriate 45-degree wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

E. Make joints of "No-Hub" cast iron soil pipe with coupling assembly using torque wrench pre-set at 60 inch pounds.

F. Install Thrust blocks at the bottom of the waste stack, condensate stack and rain leader pipe.

G. Install sleeve and mechanical sleeve seal through foundation wall for watertight installation.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Install expansion joints on vertical risers as indicated and as required by the plumbing code.

B. Above Ground Cleanouts: Install in above ground piping as indicated:

1. As required by plumbing code.
2. At each change in direction of piping greater than 45 degrees.
3. At minimum intervals of 50' for piping 3" and smaller, 75' piping 4" and larger.
4. At base of each vertical soil or waste stack.

C. Cleanouts Covers: Install floor and wall cleanout covers for concealed piping, types as indicated.

D. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

E. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.5 INSTALLATION OF TRAP PRIMERS

A. Install trap primers with piping pitched towards drain trap, minimum of 1/8" per foot (1 percent). Adjust trap primer for proper flow.

3.6 CONNECTIONS

A. Piping Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.

B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.7 FIELD QUALITY CONTROL

A. Inspections:

1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.

2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.

   a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
   b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.

3. Reinspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for reinspection by the plumbing official.

3.8 PIPING SYSTEM TEST

A. Test for leaks and defects all new drainage and vent piping systems.

B. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.

C. Drainage and Venting System Testing Procedures:

1. Rough Plumbing: Test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
2. Finished Plumbing: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into

the system equal to a pressure of 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.

D. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

3.9 ADJUSTING AND CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.10 PROTECTION

A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

END OF SECTION 22 13 21

SECTION 22 15 13
GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes piping and related specialties for general-service compressed-air systems:

1. Pipes, tubes, and fittings.
2. Joining materials.
3. Valves.
4. Dielectric fittings.
5. Flexible pipe connectors.
6. Specialties.
7. Quick couplings.
8. Hose assemblies.

B. Related Sections include the following:

1. Refer to the section, "General Plumbing Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

1.3 DEFINITIONS

A. High-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures between 150 and 200 psig.

B. Low-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures of 150 psig or less.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Compressed-air piping and support and installation shall withstand effects of seismic events determined according to SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Extruded-Tee Outlet Procedure: Qualify operators according to training provided by T-DRILL Industries Inc., for making branch outlets.
2. Pressure-Seal Joining Procedure for Copper Tubing: Qualify operators according to training provided by Viega; Plumbing and Heating Systems.
3. Pressure-Seal Joining Procedure for Steel Piping. Qualify operators according to training provided by Victaulic Company.
4. Joining Procedures for Aluminum Piping Systems: Qualify installers according to training provided by manufacturers.

B. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or to AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

D. ASME Compliance:

1. Comply with ASME B31.1, "Power Piping," for high-pressure compressed-air piping.
2. Comply with ASME B31.3, "Process Piping," for high- and low-pressure compressed-air piping.
3. Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L seamless, drawn-temper, water tube.

1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
3. Copper Unions: ASME B16.22 or MSS SP-123.
4. Press-Type Fittings, NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Apollo Flow Controls; Conbraco Industries, Inc.
2) Elkhart Products Corporation.
3) Viega LLC.

5. Press-Type Fittings, NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

a. Manufacturers: Subject to compliance with requirements, provide products by the following:

1) Viega LLC.

6. Grooved-End Fittings and Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Anvil International.
2) Grinnell Mechanical Products.
3) Victaulic Company.

b. Grooved-End Fittings: ASTM B 75, copper tube or ASTM B 584, bronze castings.
c. Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for compressed air, and bolts and nuts. Provide EDPM gasket for oil-free compressed air. Provide NBR gasket if compressed air contains oil or oil vapor.

B. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 VALVES

A. Metal Ball, Butterfly, Check, and Gate Valves: Comply with requirements in Section 22 05 23 “Valves, Cocks and Specialties for Plumbing Systems”.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. A.Y. McDonald Mfg. Co.
   b. Capitol Manufacturing Company.
   c. Central Plastics Company.
   d. HART Industrial Unions, LLC.
   e. Jomar Valve.
   f. Matco-Norca.
   g. WATTS.
   h. Wilkins.

2. Description:

   a. Standard: ASSE 1079.
   b. Pressure Rating: 250 psig.
   c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Matco-Norca.
   d. WATTS.
   e. Wilkins.

2. Description:

   a. Standard: ASSE 1079.
   b. Factory-fabricated, bolted, companion-flange assembly.
   c. Pressure Rating: 300 psig.
   d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.

2. Description:

   a. Nonconducting materials for field assembly of companion flanges.
   b. Pressure Rating: 150psig.
   c. Gasket: Neoprene or phenolic.

d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

2.5 FLEXIBLE PIPE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Hyspan Precision Products, Inc.
4. Mercer Rubber Co.
5. Metraflex Company (The).
6. Proco Products, Inc.
7. Unaflex.
8. Universal Metal Hose.

B. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: 250 psig minimum.
2. End Connections, NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections, NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: 250 psig minimum.
2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.
3. End Connections, NPS 2-1/2 and Larger: Flanged steel nipple.

2.6 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.

1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig inlet pressure, unless otherwise indicated.

1. Type: Pilot operated.

C. Air-Line Pressure Regulators: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.

D. Air-Line Pressure Regulators: Diaphragm operated, aluminum alloy or plastic body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.

E. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate.

F. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded.

G. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock.

H. Air-Line Lubricators: With drip chamber and sight dome for observing oil drop entering air stream; with oil-feed adjustment screw and quick-release collar for easy bowl removal.

1. Provide with automatic feed device for supplying oil to lubricator.

2.7 QUICK COUPLINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aeroquip Corporation.
2. Bowes Manufacturing Inc.
3. Foster Manufacturing, Inc.
4. Milton Industries, Inc.
5. Parker Hannifin Corp.
6. Rectus Corp.
7. Schrader-Bridgeport/Standard Thomson.
8. TOMCO Products Inc.
9. Tuthill Corporation.

B. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.

C. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.

1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
2. Plug End: Flow-sensor-bleeder, check-valve type with barbed outlet for attaching hose.

D. Valveless Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.

1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
2. Plug End: With barbed outlet for attaching hose.

2.8 HOSE ASSEMBLIES

A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig minimum working pressure, unless otherwise indicated.

1. Hose: Reinforced single- or double-wire-braid, CR-covered hose for compressed-air service.
2. Hose Clamps: Stainless-steel clamps or bands.
3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Metal General-Duty Valves: Comply with requirements and use valve types specified in Section 22 05 23 “Valves, Cocks and Specialties for Plumbing Systems" according to the following:

1. Low-Pressure Compressed Air: Valve types specified for low-pressure compressed air.
2. High-Pressure Compressed Air: Valve types specified for medium-pressure compressed air.
3. Equipment Isolation NPS 2 and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.
4. Grooved-end valves may be used with grooved-end piping and grooved joints.

3.2 PIPING INSTALLATION, GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.

E. Install piping adjacent to equipment and machines to allow service and maintenance.

F. Install air and drain piping with 1 percent slope downward in direction of flow.

G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.

H. Equipment and Specialty Flanged Connections:

1. Use steel companion flange with gasket for connection to steel pipe.

2. Use cast-copper-alloy companion flange with gasket and brazed[**or soldered**] joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.

I. Flanged joints may be used instead of specified joint for any piping or tubing system.

J. Extended-tee outlets with brazed branch connection may be used for copper tubing, within extruded-tee connection diameter to run tube diameter ratio for tube type, according to Extruded Tee Connections Sizes and Wall Thickness for Copper Tube (Inches) Table in ASTM F 2014.

K. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

L. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

M. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver.

N. Install piping to permit valve servicing.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Grooved Joints: Assemble couplings with housing, gasket, lubricant, and bolts. Join according to AWWA C606 for grooved joints. Do not apply lubricant to prelubricated gaskets.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Section 22 05 23 “Valves, Cocks and Specialties for Plumbing Systems."

B. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.

C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.

D. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

3.5 SPECIALTY INSTALLATION

A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.

B. Install air-main pressure regulators in compressed-air piping at or near air compressors.

C. Install air-line pressure regulators in branch piping to equipment and tools.

D. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.

E. Install coalescing filters in compressed-air piping at or near air compressors and upstream from mechanical filters.

F. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters.

G. Install air-line lubricators in branch piping to machine tools.

H. Install quick couplings at piping terminals for hose connections.

I. Install hose assemblies at hose connections.

3.6 CONNECTIONS

A. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.

B. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment and machine.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

B. Vertical Piping: MSS Type 8 or 42, clamps.

C. Individual, Straight, Horizontal Piping Runs:

1. 100 Feet or Less: MSS Type 1, adjustable, steel clevis hangers.
2. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

D. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

E. Base of Vertical Piping: MSS Type 52, spring hangers.

F. Support horizontal piping within 12 inches of each fitting and coupling.

G. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4: 60 inches with 3/8-inch rod.
2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
3. NPS 3/4: 84 inches with 3/8-inch rod.
4. NPS 1: 96 inches with 3/8-inch rod.
5. NPS 1-1/4: 108 inches with 3/8-inch rod.
6. NPS 1-1/2: 10 feet with 3/8-inch rod.
7. NPS 2: 11 feet with 3/8-inch rod.
8. NPS 2-1/2: 13 feet with 1/2-inch rod.
9. NPS 3: 14 feet with 1/2-inch rod.
10. NPS 3-1/2: 15 feet with 1/2-inch rod.
11. NPS 4: 16 feet with 1/2-inch rod.
12. NPS 5: 18 feet with 1/2-inch rod.
13. NPS 6: 20 feet with 5/8-inch rod.
14. NPS 8: 23 feet with 3/4-inch rod.

I. Install supports for vertical copper tubing every 10 feet.

3.8 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

B. Paint shall be oil base, first quality, suitable for copper pipe application. Two coats shall be applied by brush application (aerosol type application is not acceptable). Identification shall be by 6" wide bands at 8'-0" centers. Acceptable manufacturers are Sherwin-Williams Pittsburgh Paints, Glidden or approved equals.

3.9 FIELD QUALITY CONTROL

A. Blowing Out: After erection of the piping, but before installing the service outlet valves and before connecting the vacuum pump, air compressor and main oxygen, the lines shall be blown clear of free moisture and foreign matter by means of oil free, water pumped, nitrogen or compressed air

B. Joint Test:

1. After installing piping service valves, the system shall be subjected to an initial test pressure of 1.5 times the system operating pressure (200 psig maximum) by means of oil-free, water pumped, nitrogen or compressed air for a period of 24 hours. No pressure drop will be permitted except that due to temperature drop.
2. If the system is found to be leaking, test each joint, under pressure, by means of soap test. A soap solution mixed in the following proportions shall be used; 1 ounce of castile or palm oil soap, 8 ounces of water and 4 ounces of glycerin, mixed thoroughly. Wipe joints clean after test
3. Leaks shall be properly repaired and the systems retested.
4. Final Test: Shall be twenty-four hour standing pressure test with cylinder water pumped compressed air or cylinder water pumped nitrogen at 1.5 times system operating pressure. All outlets, pressure switches, alarms and pressure gages shall be installed during the final test to check the completeness of prior joint pressure tests. If cylinder water pumped nitrogen is used, particular care must be exercised to assure that it is flushed out with oxygen before placing system in service.

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SECTION 22 16 00
FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Manual gas shutoff valves.
5. Motorized gas valves.
6. Pressure regulators.
7. Service meters.
8. Dielectric fittings.

1.3 ACTION SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced

1.4 RELATION TO OTHER WORK

A. Refer to the section, "General Plumbing Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

1.5 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.7 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig but not more than 5 psig.

C. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.

D. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 2 psig but not more than 5 psig, and is reduced to secondary pressure of more than 0.5 psig but not more than 2 psig.

E. Natural-Gas System Pressures within Buildings: Three pressure ranges. Primary pressure is more than 2 psig but not more than 5 psig, and is reduced to secondary pressures of more than 0.5 psig but not more than 2 psig, and is reduced again to pressures of 0.5 psig or less.

2.2 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

6. Mechanical Couplings:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) GE Oil & Gas.
        2) Smith-Blair, Inc.

    b. Flanges and tube with epoxy finish.
    c. Buna-nitrile seals.
    d. Bolts, washers, and nuts.
    e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
    f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. FlashShield Products; Gastite, a division of Titeflex Corp.
    b. TracPipe CounterStrike; Omega Flex, Inc.
    c. Tru-Flex Metal Hose Corp.
    d. Ward Manufacturing LLC.

2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.

3. Coating: PE with flame retardant.

    a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

        1) Flame-Spread Index: 25 or less.
        2) Smoke-Developed Index: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
5. Striker Plates: Steel, designed to protect tubing from penetrations.
6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
7. Operating-Pressure Rating: 5 psig.

2.3 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches.

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: Startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.

3. Strainer Screen: Startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

E. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: Startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.4 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.5 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
5. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

B. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Service Mark: Initials "WOG" shall be permanently marked on valve body.

C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A.Y. McDonald Mfg. Co.
b. Apollo Flow Controls; Conbraco Industries, Inc.

c. BrassCraft Manufacturing Co.; a Masco company.
d. Lyall, R. W. & Company, Inc.
e. Perfection Corporation.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. CWP Rating: 600 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A.Y. McDonald Mfg. Co.
b. Apollo Flow Controls; Conbraco Industries, Inc.
c. BrassCraft Manufacturing Co.; a Masco company.
d. Lyall, R. W. & Company, Inc.
e. Perfection Corporation.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. CWP Rating: 600 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A.Y. McDonald Mfg. Co.
b. Apollo Flow Controls; Conbraco Industries, Inc.
c. BrassCraft Manufacturing Co.; a Masco company.
d. Lyall, R. W. & Company, Inc.
e. Perfection Corporation.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. CWP Rating: 600 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. A.Y. McDonald Mfg. Co.
    b. Lee Brass Company.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Operator: Square head or lug type with tamperproof feature where indicated.
5. Pressure Class: 125 psig.
6. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. A.Y. McDonald Mfg. Co.
    b. Mueller Co.
    c. Xomox Corporation.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Operator: Square head or lug type with tamperproof feature where indicated.
7. Pressure Class: 125 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

H. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Flowserve Corporation.
    b. Homestead Valve.
    c. Milliken Valve Company.
    d. Mueller Co.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Operator: Square head or lug type with tamperproof feature where indicated.
7. Pressure Class: 125 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

I. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.6 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Assco
   b. Honeywell Building Solutions; Honeywell International, Inc.
   c. Johnson Controls.

2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. Normally closed.
6. Visual position indicator.

B. Electrically Operated Valves: Comply with UL 429.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Assco
   b. Eclipse Innovative Thermal Technologies.
   c. Goyen Valve Corp.
   d. Magnatrol Valve Corporation.
   e. Parker Hannifin Corporation.
   f. WATTS.

2. Pilot operated.
3. Body: Brass or aluminum.
4. Seats and Disc: Nitrile rubber.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

2.7 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.

2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. At each point where a gas line enters a building, that line shall be equipped with a pressure reducing regulator to reduce gas pressure to seven inches water column before the building entry. Such regulators shall be equipped with a high outlet pressure shut off device requiring manual reset sized to interrupt gas flow if the outlet pressure exceeds set pressure by fourteen (14) inches water column. Regulators should be capable of delivering the required gas volume with 5 psig inlet pressure and seven inch water column outlet pressure and shall be rated for a minimum sixty (60) psig inlet working pressure. Fisher types S-105 and S-205 or S-207 or approved equal type regulator shall be used.
2. Provide auxiliary gas pressure regulators at each equipment location for gas distribution system pressures greater than 2 psig. Regulators shall be capable of delivering the required gas volume with a seven inch water column outlet pressure.

2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. A.Y. McDonald Mfg. Co.
   b. Capitol Manufacturing Company.
   c. Central Plastics Company.
   d. HART Industrial Unions, LLC.
   e. Jomar Valve.
   f. Matco-Norca.
   g. WATTS.
   h. Wilkins.
   i. Zurn Industries, LLC.

2. Description:

   a. Standard: ASSE 1079.
   b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Matco-Norca.

d. WATTS.
e. Wilkins.

2. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Gasket: Neoprene or phenolic.
c. Bolt Sleeves: Phenolic or polyethylene.
d. Washers: Phenolic with steel backing washers.

2.9 EMERGENCY SHUTOFF VALVE

A. Gas emergency shut off valve (3/4" to 3" IPS) shall be aluminum body threaded pattern with Buna N Disc solenoid type with free reset handle to shut off the fuel gas instantly upon de-energization of electric power. The free handle will not open the valve until the solenoid is energized which will allow the lever to engage. Then the lever can be manually raised to the latched position, opening the valve. The valve will trip closed instantly when the solenoid is de-energized.

B. Manual reset movement shall be heavy-duty sealed unit with a highly visible position indicator showing valve position. Top movement can be rotated to any of 4 positions (90 degrees apart) to best locate the handle and visual indicator.

C. Valve shall be outdoor rated.

2.10 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

E. Install fittings for changes in direction and branch connections.

F. Install pressure gage upstream and downstream from each service regulator.

3.4 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.

4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

    a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

    a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage upstream and downstream from each line regulator.

W. Install sleeves for piping penetrations of walls, ceilings, and floors.

X. Install sleeve seals for piping penetrations of concrete walls and slabs.

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.7 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices.

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

C. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. NPS 1/2 and NPS 5/8: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and NPS 7/8: Maximum span, 84 inches; minimum rod size, 3/8 inch.
4. NPS 1: Maximum span, 96 inches; minimum rod size, 3/8 inch.

D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.8 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 PAINTING

A. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

B. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be one the following:

1. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.

B. Aboveground natural-gas piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

C. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with steel welding fittings and welded joints.

C. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 5 PSIG

A. Aboveground Piping: Maximum operating pressure more than 5 psig.

B. Aboveground, Branch Piping: Steel pipe with steel welding fittings and welded joints.

C. Aboveground, distribution piping shall be the following:

1. Steel pipe with steel welding fittings and welded joints.

D. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

E. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

F. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.16 MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, bronze ball valves with bronze trim.
3. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:

1. Two-piece, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, nonlubricated plug valve.

C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, bronze ball valves with bronze trim.
3. Bronze plug valve.

D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:

1. Two-piece, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, plug valve.

E. Valves in branch piping for single appliance shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, bronze ball valves with bronze trim.
3. Bronze plug valve.

END OF SECTION 22 16 00

SECTION 22 33 13
DOMESTIC WATER HEATERS, POINT-OF-USE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install water heater including all valves, fittings, heat trap and appurtenances.

B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

1.5 MANUFACTURERS

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Eemax

PART 2 - PRODUCTS

2.1 GENERAL

A. Point-of-use water heater casing shall be constructed of cast aluminum alloy, or ABS UL rated 94 Vo.

B. Heating coils shall be NI chrome elements with celcon waterways, or an approved equal.

C. Point-of-use water heaters shall have proper UL listing for intended use.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide ball valve and shock arrestor on the incoming cold water supply piping.

B. Provide compression fittings to facilitate replacement of the heater.

END OF SECTION 22 33 13

SECTION 22 34 00
FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
2. Commercial, large-volume, oil-fired, domestic-water heaters.
3. Domestic-water heater accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

1.5 RELATION TO OTHER WORK

A. Refer to the section, "General Plumbing Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. All units shall have a 3 year limited warranty against tank failure.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Smith, A. O. Corporation.
b. Lochinvar, LLC
c. Rheem Manufacturing Company.
d. State Industries.

2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Description: Manufacturer's proprietary design to provide at least 95 percent combustion efficiency at optimum operating conditions.

4. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.

    a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

        1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
        2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

    b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    c. Lining: Glass complying with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

5. Factory-Installed Storage-Tank Appurtenances:

    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
    d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
    e. Jacket: Steel with enameled finish.
    f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
    g. Temperature Control: Adjustable thermostat.
    h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
    i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

6. Draft Hood: Draft diverter, complying with ANSI Z21.12. If more than one commercial, gas-fired, storage, domestic-water heater is required on Project, delete paragraph below and schedule commercial, gas-fired, storage, domestic-water heaters on Drawings.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Honeywell Water Controls.
    c. Smith, A. O. Corporation.
    d. State Industries.
    e. Taco, Inc.

2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

    a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

    a. Working-Pressure Rating: 150 psig.
    b. Capacity Acceptable: 10 gal. minimum.
    c. Air Precharge Pressure: Building domestic supply pressure.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and calibrated balancing valves to provide balanced flow through each domestic-water heater.

F. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 22 05 23 “Valves, Cocks and Specialties for Plumbing Systems”.

    1. Comply with requirements for balancing valves specified in Section 22 11 19 "Domestic Water Piping Specialties."

G. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

H. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include specified pressure rating as required to match gas supply.

I. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

J. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

    1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
    2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

K. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

L. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

M. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

N. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test water heaters to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting and reinspecting requirements and Section 01 73 00 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base.

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Tankless, Domestic-Water Heater Mounting: Install tankless, domestic-water heaters at least 18 inches above floor on wall bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

C. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23 “Valves, Cocks and Specialties for Plumbing Systems”.

D. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.

E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install combination temperature & pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

G. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains.

H. Install thermometer on outlet piping of domestic-water heaters.

I. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 22 05 23 “Valves, Cocks and Specialties for Plumbing Systems”.

J. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

K. Fill domestic-water heaters with water.

L. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 22 11 16 "Domestic Water Piping."

B. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

END OF SECTION 22 34 00

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SECTION 22 34 05
DOMESTIC WATER HEATERS, COMMERCIAL ELECTRIC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install water heater including all valves, fittings, overflow drain pan, relief valve, heat trap and appurtenances.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

1.5 MANUFACTURERS

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Lochinvar
2. A. O. Smith

PART 2 - PRODUCTS

2.1 MATERIALS

A. Water heater shall be of size, voltage and wattage as shown on drawings. Tank shall be 300 p.s.i. test pressure, 150 p.s.i. W.P. approved; glass lined, with 1.315 dia. "Dow" magnesium tank saver. Elements will be copper sheath, tin coated immersion type, low watt density (75 watts p.s.i. maximum). Tank shall be insulated to ASHRAE 90A-1980 energy efficiency standards. Heater jacket shall be heavy gauge steel with baked enamel finish. Internal wiring shall be composed of solid copper wire having an insulation material rated at 600 V, 200 C. Heater shall have a factory installed temperature and pressure relief valve.

B. Control Circuit:

1. Surface Mounted Thermostats: Individual thermostats with built-in manual reset hi limit providing staged control and over-temperature protection for each heating element.
2. Immersion Thermostats: Supplied with one magnetic contactor for each 18 KW increment. 120 volt control circuit with built in transformer.

C. Water heater shall be U.L. listed and approved and shall be fused in accordance with U.L. requirements.

D. Water heater to be size voltage and wattage as shown on drawings. Heater to be completely insulated and jacketed for (vertical) or (horizontal) installation. The jacket shall be rectangular 16-gauge galvanized steel with beige acrylic enamel finish. Jacket shall have a full-length hinged access door with key lock. Tank insulation shall be high-density fiberglass sufficient to meet ASHRAE 90A-1980 standards of 4 watts per square foot of tank surface maximum energy loss. Key lock door provides additional safety and security.

E. Tank construction shall be 300-pound test. 125-pound working pressure and be ASME stamped and National Board listed. All tanks are to be lined with vitreous glass, fired at 1600 F. provided molecular interchange of glass and steel. Manhole cleanout shall be standard on 500 through 2500 gallon models.

F. Handhole cleanout on heaters under 500 gallons heater shall include the following standard features: internal fusing for control and load circuits, built-in safety drain pan with piping connections, low-watt density incoloy sheath elements, ASME rated temperature and pressure relief valve, terminal block wiring, 180^{o}F water temperature approval, U.L. listing, 3 year limited warranty.

G. Control system: Individual thermostats with built in manual reset hi limit providing staged control and hi-limit safety for each heating element. (Not available on horizontal models) -OR-

H. Magnetic contactors with immersion thermostat: 120 volt control with built in transformer.

I. The discharge from the relief valve shall be piped full-size separately to the outside of the building or to another approved terminal as provided for safety pan drain terminals but in no case shall the discharge from a relief valve be trapped.

J. Provide magnesium storage tank savers.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide gate valves on both the incoming cold water and leaving hot water supply piping.

B. Cold water supply shall also be equipped with a check valve down stream of the gate valve. Remove flapper from check valve and drill a 1/16 inch hole in flapper. Replace flapper in valve body.

C. Provide unions to facilitate replacement of the storage tank and/or heater.

D. Heat trap shall be installed in the hot water supply piping.

END OF SECTION 22 34 05

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SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Related Sections:

1. Separate grab bars and toilet accessories not an integral part of plumbing fixtures are specified in Division-10.

C. This Section specifies plumbing fixtures and trim. The types of fixtures specified included the following:

1. Lavatories (including wheelchair type);
2. Service Sinks;
3. Water Closets;
4. Urinals;
5. Mop Basins;
6. Drinking Fountains;
7. Faucets;
8. Flush Valves;
9. Fixture Supports (including wheelchair type);
10. Toilet Seats;
11. Electric Water Heater;

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. ASHRAE Standard 18: "Method of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration Systems."
2. ARI Standard 1010: "Drinking-Fountains and Self-Contained Mechanically-Refrigerated Drinking-Water Coolers."
3. ANSI Standard All7.1: "Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People."
4. Public Law 90-480: "Architectural Barriers Act of 1968."
5. UL Standard 399: "Drinking-Water Coolers."

B. Delivery, Storage, and Handling:

1. Store fixtures where environmental conditions are uniformly maintained within the manufacturer's recommended temperatures to prevent damage.
2. Store fixtures and trim in the manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage to the fixture on trim.

C. Sequence and Scheduling:

1. Schedule rough-in installations with the installation of other building components.

1.3 MAINTENANCE

A. Extra Stock:

1. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt in a quantity of one device for each 10 fixtures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer uniformity shall be as specified in Section 23 05 00: Basic Mechanical Requirements under Product Options.

1. Subject to compliance with specified requirements, provide plumbing fixtures of one of the following:

a. Lavatories, Service Sinks, Water Closets, Urinals, Showers:

(a) Moen (Owner Preferred)
(b) Sloan
(c) Kohler Co.
(d) American Standard.

b. Faucets:

(a) Moen single handle 8884 (Owner Preferred)
(b) Chicago Faucet Co.
(c) Sloan
(d) Kohler Co.
(e) American Standard.

c. Flush Valves:

(a) Sloan Valve Co.
(b) American Standard.

d. Water Closet Seats:

(a) Bemis Mfg. Co.
(b) Beneke Corp.
(c) American Standard.

e. Water Coolers:

(a) Elkay Mfg. Co.
(b) Filtrine Manufacturing Co.
(c) Haws Drinking Faucet Co.

f. Service Sinks:

(a) Crane Co.
(b) American Standard
(c) Kohler Co.

g. Fixture Supports:

(a) Watts
(b) Kohler Co.
(c) Josam Mfg. Co.

2.2 FIXTURES (See schedule)

2.3 WATER COOLERS (See schedule)

2.4 FAUCETS (See schedule)

2.5 FLUSH VALVES (See schedule)

2.6 FIXTURE SUPPORTS (See schedule)

2.7 ELECTRIC WATER HEATER (See schedule)

2.8 FITTINGS, TRIM AND ACCESSORIES

A. Toilet Seats: elongated, solid white plastic, closed back/open front, less cover, and having stainless steel check hinge and replaceable bumpers.

2.9 ESCUTCHEONS

A. Chrome-plated cast brass with set screw.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.

C. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.

B. Comply with the installation requirements of ANSI All1.1 and Public Law 90-480 with respect to plumbing fixtures for the physically handicapped.

C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.

D. Set shower receptor and mop basins in a leveling bed of cement grout.

E. Install a stop valve in an accessible location in the water connection to each fixture.

F. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.

G. Seal fixtures to walls and floors using silicone sealant as specified in Section 07 92 00. Match sealant color to fixture color.

3.3 FIELD QUALITY CONTROL

A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.

B. Inspect each installed unit for damage. Replace damaged fixtures.

3.4 ADJUSTING

A. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow and stream.

B. Replace washers of leaking or dripping faucets and stops. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.5 CLEANING

A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.6 PROTECTION

A. Provide protective covering for installed fixtures, water coolers, and trim.

B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.

3.7 ROUGH-IN SCHEDULE (Refer to Drawings)

3.8 MOUNTING HEIGHTS SCHEDULE

Fixture	Mounting Height
Water Closet	15" floor to rim
Wheelchair Water Closet	18" floor to rim
Standard Urinals	22" floor to rim
Adult Standard Water Cooler	40" floor to rim
Wheelchair Water Cooler	35" floor to rim
Adult Standard Drinking Fountains	40" floor to rim
Wheelchair Drinking Fountain	35" floor to rim

END OF SECTION 22 40 00

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SECTION 22 40 05
PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install plumbing fixtures indicated on drawings or specified herein.

B. All plumbing fixtures shall be "First Quality" as defined and set forth in Commercial Standard CS77-28 as promulgated by the U.S. Department of Commerce. All fixtures are to be white vitreous china unless otherwise specifically noted. Where enameled iron fixtures are specified, they shall be furnished with acid resisting enamel.

C. Fixtures shall be properly protected from damage during construction and shall be cleaned in accordance with manufacturer's instruction under this section of the specifications.

D. Fixtures and fittings proposed shall be from one manufacturer and of similar character in any room or location. Escutcheons, handles, etc., on the different fixtures shall be of the same design.

E. The fixture numbers and types are scheduled on the drawings, and are used to indicate type and quality of fixtures desired. Acceptable fixture manufacturers are as follows: American Standard, Eljer and Kohler. Fixture manufacturers not listed herein will be considered subject to the general requirement outlined in Section 23 01 00 General Mechanical Provisions.

F. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Flush valves and water closet seats shall be as scheduled on the drawings.

B. All exposed metal not otherwise specified shall be polished chromium on brass or bronze. All supply valves shall have renewable seats and discs. All hot and cold water supply to fixtures shall be provided with stops. Provide P-trap with cleanout for each lavatory and sink except as specifically noted.

C. All seats shall be solid, white, open front seat with checking and self sustaining, stainless steel hinge.

D. Chair carriers and combination chair carriers and fittings shall be as scheduled on the drawings.

E. Chrome-plated. Provide where exposed piping passes through finished surfaces. Escutcheons for extended sleeves shall be of the type designed for that purpose.

F. Provide a concealed hanger type lavatory chair carrier with short foot mounted in the chase to support lavatories shown on walls of a chase.

G. Provide through toggle bolts, 1/8" thickness steel backing plate, and wall hangers for support of lavatories on 6" or thicker concrete block walls.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Layout fixtures as indicated on the drawings.

B. Carefully install fixtures in accordance with manufacturer's data with sufficient clearances to coordinate with accessories, specialties and equipment specified in other divisions of these specifications and/or as shown on the drawings.

C. Hangers and carriers shall be installed in accordance with manufacturer's recommendations and in accordance with good practice and workmanship.

D. Clean all exposed metal surfaces from grease, dirt, paint or other foreign material.

E. Fixtures shall be properly protected from damage during construction and shall be cleaned in accordance with manufacturer's instruction under this section of the specification.

F. Fixtures, chrome-plated piping, fittings and trim shall be polished before requesting acceptance of the system.

END OF SECTION 22 40 05

SECTION 22 61 13
DENTAL COMPRESSED-AIR PIPE AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Dental compressed-air piping, designated "dental air."

1.3 DEFINITIONS

A. Compressed air piping systems include dental air.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Seismic Qualification Certificates: For medical compressed-air manifolds, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Material Certificates: Signed by Installer certifying that medical compressed-air piping materials comply with requirements in NFPA 99 for positive-pressure medical gas systems.

D. Brazing certificates.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Quick-Coupler Service Connections: Furnish complete noninterchangeable medical compressed-air pressure outlets.

a. Medical Air: Equal to 10 percent of amount installed, but no fewer than 3 units.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Medical Air Piping Systems for Healthcare Facilities: According to ASSE Standard #6010 for medical-gas-system installers.
2. Shape-Memory-Metal Coupling Joints: An authorized representative who is trained and approved by manufacturer.

B. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications"; or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Dental air operating at 100 psig.

2.2 PIPES, TUBES, AND FITTINGS

A. Comply with NFPA 99 for medical air piping materials.

B. Copper Tube: ASTM B 819, Type K seamless, drawn temper, that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "MED AIR" in green for Type K tube and in blue for Type L tube.

C. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type that has been manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Kleenfit, made in USA, or comparable product by one of the following:

a. NIBCO INC.

D. Copper Unions: ASME B16.22 or MSS SP-123, wrought-copper or cast-copper alloy.

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Kleenfit, made in USA, or comparable product by one of the following:

a. NIBCO INC.

E. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150.

1. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, full-face type.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.

F. Shape-Memory-Metal Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aerofit, Inc.
b. Smart Tap; Smart Technology, Inc.

2. Description: Cryogenic compression fitting made of nickel-titanium, shape-memory alloy, and that has been manufacturer cleaned, purged, and sealed for oxygen service according to CGA G-4.1.

G. Flexible Pipe Connectors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flex-Hose Co., Inc.
b. Flexicraft Industries.
c. Hyspan Precision Products, Inc.
d. Mercer Rubber Co.
e. Metraflex Company (The).
f. Proco Products, Inc.
g. Unaflex.
h. Universal Metal Hose.

2. Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

a. Working-Pressure Rating: 200 psig minimum.
b. End Connections: Plain-end copper tube.

2.3 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.

B. Threaded-Joint Tape: PTFE.

2.4 VALVES

A. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.

B. Ball Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo, Conbraco Industries, Inc. 82A or comparable product by one of the following:

    a. Allied Healthcare Products Inc.
    b. NIBCO INC.

2. Standard: MSS SP-110.
3. Description: Three-piece body, brass or bronze.
4. Pressure Rating: 300 psig (2070 kPa) minimum.
5. Ball: Full-port, chrome-plated brass.
6. Seats: PTFE or TFE.
7. Handle: Lever type with locking device.
8. Stem: Blowout proof with PTFE or TFE seal.

C. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Healthcare Products Inc.
    b. Amico Corporation.
    c. BeaconMedaes.
    d. Ohio Medical Corporation.
    e. Tri-Tech Medical.

2. Description: In-line pattern, bronze.
3. Pressure Rating: 300 psig minimum.
4. Operation: Spring loaded.
5. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

D. Safety Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Conbraco Industries, Inc. 520 or comparable product by one of the following:
2. Bronze body.
3. ASME-construction, poppet, pressure-relief type.
4. Settings to match system requirements.

E. Pressure Regulators:

1. Bronze body and trim.
2. Spring-loaded, diaphragm-operated, relieving type.
3. Manual pressure-setting adjustment.
4. Rated for 250-psig minimum inlet pressure.
5. Capable of controlling delivered air pressure within 0.5 psig for each 10-psig inlet pressure.

2.5 MEDICAL COMPRESSED-AIR SERVICE CONNECTIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Healthcare Products Inc.
2. Amico Corporation.
3. BeaconMedaes.
4. Ohio Medical Corporation.

B. General Requirements for Medical Compressed-Air Service Connections:

1. Suitable for specific medical air pressure and service listed.
2. Include roughing-in assemblies, finishing assemblies, and cover plates.
3. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate.
4. Recessed-type units made for concealed piping unless otherwise indicated.

C. Roughing-in Assembly:

1. Steel outlet box for recessed mounting and concealed piping.
2. Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed.
3. Double seals that will prevent air leakage.
4. ASTM B 819, NPS 3/8 (DN 10) copper outlet tube brazed to valve with service marking and tube-end dust cap.

D. Finishing Assembly:

1. Brass housing with primary check valve.
2. Double seals that will prevent air leakage.
3. Cover plate with gas-service label.

E. Quick-Coupler Pressure Service Connections:

1. Outlets for medical air with noninterchangeable keyed indexing to prevent interchange between services.
2. Constructed to permit one-handed connection and removal of equipment.
3. With positive-locking ring that retains equipment stem in valve during use.

F. Cover Plates:

1. One piece.
2. Aluminum or stainless steel.
3. Permanent, color-coded, identifying label matching corresponding service.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing is not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction perform the following procedures:

1. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1.
2. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb (0.453 kg) of chemical to 3 gal. (11.3 L) of water.

    a. Scrub to ensure complete cleaning.
    b. Rinse with clean, hot water to remove cleaning solution.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Comply with NFPA 99 for installation of compressed-air piping.

C. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.

F. Install piping adjacent to equipment and specialties to allow service and maintenance.

G. Install compressed-air piping with 1 percent slope downward in direction of flow.

H. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.

I. Install eccentric reducers, if available, where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

J. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

K. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver.

L. Install piping to permit valve servicing.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and for branch connections.

O. Install medical air piping to medical air service connections specified in this Section, to medical air service connections in equipment specified in Section 22 63 13 "Gas Piping for Laboratory and Healthcare Facilities," and to equipment specified in other Sections requiring medical air service.

P. Piping Restraint Installation: Install seismic restraints on compressed-air piping. Seismic-restraint devices are specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

Q. Install compressed-air service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.

R. Connect compressed-air piping to air compressors and to compressed-air outlets and equipment requiring compressed-air service.

S. Install unions in copper compressed-air tubing adjacent to each valve and at final connection to each machine, specialty, and piece of equipment.

T. Install sleeves for piping penetrations of walls, ceilings, and floors.

U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 VALVE INSTALLATION

A. Install shutoff valve at each connection to and from compressed-air equipment and specialties.

B. Install check valves to maintain correct direction of compressed-air flow from compressed-air equipment.

C. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.

D. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.

E. Install pressure regulators on compressed-air piping where reduced pressure is required.

F. Install flexible pipe connectors in discharge piping and in inlet air piping from remote air-inlet filter of each air compressor.

3.4 JOINT CONSTRUCTION

A. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.

B. Threaded Joints: Apply appropriate tape to external pipe threads.

C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" chapter. Continuously purge joint with oil-free dry nitrogen during brazing.

D. Flanged Joints: Install flange on copper tubes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.

E. Shape-Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of shape-memory-metal coupling joints.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

B. Vertical Piping: MSS Type 8 or Type 42, clamps.

C. Individual, Straight, Horizontal Piping Runs:

1. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel, clevis hangers.
2. Longer Than 100 Feet (30 m): MSS Type 43, adjustable, roller hangers.

D. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for trapeze hangers.

E. Base of Vertical Piping: MSS Type 52, spring hangers.

F. Support horizontal piping within 12 inches of each fitting and coupling.

G. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch- (10-mm-) minimum rods.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
4. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
5. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
6. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.
7. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8-inch (10-mm) rod.

I. Install supports for vertical copper tubing every 10 feet (3 m).

3.6 IDENTIFICATION

A. Install identifying labels and devices for nonmedical laboratory compressed-air piping, valves, and specialties. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

B. Install identifying labels and devices for medical compressed-air piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:

1. Dental Air: Black letters on yellow background.

3.7 FIELD QUALITY CONTROL FOR MEDICAL/DENTAL COMPRESSED-AIR PIPING

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections of medical compressed-air piping in healthcare facilities and to prepare test and inspection reports.

B. Tests and Inspections:

1. Medical/Dental Compressed-Air Testing Coordination: Perform tests, inspections, verifications, and certification of medical compressed-air piping systems concurrently with tests, inspections, and certification of medical/dental vacuum piping systems.
2. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:

    a. Initial blowdown.
    b. Initial pressure test.
    c. Cross-connection test.
    d. Piping purge test.
    e. Standing pressure test for positive-pressure medical compressed-air piping.
    f. Repair leaks and retest until no leaks exist.

3. System Verification: Perform the following tests and inspections according to NFPA 99, ASSE Standard #6020, and ASSE Standard #6030:

    a. Standing pressure test.
    b. Individual-pressurization cross-connection test.
    c. Valve test.
    d. Master and area alarm tests.
    e. Piping purge test.
    f. Piping particulate test.
    g. Piping purity test.
    h. Final tie-in test.
    i. Operational pressure test.
    j. Medical air purity test.
    k. Verify correct labeling of equipment and components.

4. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:

    a. Inspections performed.
    b. Procedures, materials, and gases used.
    c. Test methods used.

d. Results of tests.

C. Remove and replace components that do not pass tests and inspections and retest as specified above.

3.8 PROTECTION

A. Protect tubing from damage.

B. Retain sealing plugs in tubing, fittings, and specialties until installation.

C. Clean tubing not properly sealed, and where sealing is damaged, according to "Preparation" Article.

3.9 PIPING SCHEDULE

A. Connect new tubing to existing tubing with memory-metal couplings.

B. Flanges may be used where connection to flanged equipment is required.

C. Medical Air Piping except Instrument Air Piping Larger Than NPS 3 (DN 80) and Operating at More Than 185 psig (1275 kPa): Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.

3.10 VALVE SCHEDULE

A. Shutoff Valves: Ball valve with manufacturer-installed ASTM B 819, copper-tube extensions.

B. Zone Valves: Ball valve with manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.

END OF SECTION 22 61 13

SECTION 22 62 13
DENTAL VACUUM PIPING AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Dental vacuum piping, designated "dental vacuum."

1.3 DEFINITIONS

A. Medical vacuum piping systems include dental vacuum piping systems.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Material Certificates: Signed by Installer certifying that medical vacuum piping materials comply with requirements in NFPA 99.

C. Brazing certificates.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For vacuum piping specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Medical Vacuum Piping Systems for Healthcare Facilities: According to ASSE Standard #6010 for medical-gas-system installers.
2. Pressure-Seal Joining Procedure for Copper Tubing: An authorized representative who is trained and approved by manufacturer.
3. Extruded-Tee Outlet Procedure: An authorized representative who is trained and approved by manufacturer.
4. Shape-Memory-Metal Coupling Joints: An authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the vacuum piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL, and that is acceptable to authorities having jurisdiction.

1. Qualify testing personnel according to ASSE Standard #6020 for medical-gas-system inspectors and ASSE Standard #6030 for medical-gas-system verifiers.

C. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications"; or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

1.9 WARRANTY

A. Manufacturer's Special Warranty on Domestic Products: Conbraco Industries, Inc. warrants products to be free of defects in workmanship or material for a period of five years. This warranty applies to Apollo brand products with "Made in the USA" markings only. Conbraco will correct such defects by suitable repair or replacement at Conbraco's discretion.

B. Manufacturer's Special Warranty on International Products: APOLLO INTERNATIONAL products will be free of defects in workmanship or material for a period of two years. Conbraco will correct such defects by suitable repair or replacement at Conbraco's discretion.

C. Manufacturer's Warranty on LASCO Fittings, Inc. products will be free of defects in workmanship for a period of three (3) years from date of installation. The manufacturers liability under expressed or implied warranty or for any reason is limited to furnishing replacement units or granting a credit for defective units. No labor expense or consequential damages will be paid by LASCO Fittings, Inc. For complete details please refer to: http://www.lascofittings.com/assets/1824/lasco_letter_of_warranty.pdf.

D. Elkhart Products Corporation warranties our fittings to be free from defects in materials and workmanship for a period of fifty (50) years. The Elkhart Product Corporation Water Heater hoses carry a two (2) year warranty against defects in materials and workmanship. Any fitting which proves to be defective will be replaced or a credit issued, but no incidental labor charges, expenses or damages will be allowed.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Dental vacuum operating at 12 in. Hg (305 mm Hg).

2.2 PIPES, TUBES, AND FITTINGS

A. PVC Vacuum Pipe: ASTM D 1785, Schedule 80. (Below Ground and Vent/Discharge Piping).

B. Copper Vacuum Piping: Type K with brazed copper joint fittings. (Aboveground).

C. PVC Fittings: ASTM D 2467, Schedule 80; socket type.

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by LASCO Fittings, Inc. or comparable product by one of the following:

a. NIBCO INC.
b. Charlotte Pipe and Foundry Company.

D. Transition Fittings: PVC socket type with copper threaded insert on one end.

E. Flexible Pipe Connectors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flex-Hose Co., Inc.
b. Flexicraft Industries.
c. Hyspan Precision Products, Inc.
d. Mercer Rubber Co.
e. Metraflex Company (The).
f. Proco Products, Inc.
g. Unaflex.
h. Universal Metal Hose.

2. Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

a. Working-Pressure Rating: 200 psig (1380 kPa) minimum.
b. End Connections: Plain-end copper tube.

2.3 JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.

C. Threaded-Joint Tape: PTFE.

D. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer complying with ASTM F 656.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 VALVES

A. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.

1. Exception: Factory cleaning and bagging are not required for valves for WAGD service.

a. Ohio Medical Corporation.

B. Copper-Alloy Ball Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo, Conbraco Industries, Inc. 82A or comparable product by one of the following:

a. Allied Healthcare Products Inc.
b. NIBCO INC.

2. Standard: MSS SP-110.
3. Description: Three-piece body, brass or bronze.
4. Pressure Rating: 300 psig (2070 kPa) minimum.
5. Ball: Full-port, chrome-plated brass.
6. Seats: PTFE or TFE.
7. Handle: Lever type with locking device.
8. Stem: Blowout proof with PTFE or TFE seal.
9. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions and [manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.

C. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Healthcare Products Inc.
b. Amico Corporation.
c. BeaconMedaes.
d. Ohio Medical Corporation.
e. Tri-Tech Medical.

2. Description: In-line pattern, bronze.
3. Pressure Rating: 300 psig (2070 kPa) minimum.

4. Operation: Spring loaded.
5. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

2.5 MEDICAL VACUUM SERVICE CONNECTIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Healthcare Products Inc.
2. Amico Corporation.
3. BeaconMedaes.
4. Ohio Medical Corporation.
5. Oxequip Health Industries; a division of Allied Healthcare Products Inc.
6. Tri-Tech Medical.

B. General Requirements for Medical Vacuum Service Connections:

1. Suitable for specific medical vacuum service listed.
2. Include roughing-in assemblies, finishing assemblies, and cover plates.
3. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate.
4. Recessed-type units made for concealed piping unless otherwise indicated.

C. Roughing-in Assembly:

1. Steel outlet box for recessed mounting and concealed piping.
2. Brass-body inlet block.
3. Seals that will prevent vacuum leakage.
4. ASTM B 819, NPS 3/8 (DN 10) copper outlet tube brazed to valve with service marking and tube-end dust cap.

D. Finishing Assembly:

1. Brass housing with primary check valve.
2. Seals that will prevent vacuum leakage.
3. Cover plate with gas-service label.

E. Quick-Coupler Suction Service Connections:

1. Inlets for medical vacuum with noninterchangeable keyed indexing to prevent interchange between services.
2. Constructed to permit one-handed connection and removal of equipment.
3. With positive-locking ring that retains equipment stem in valve during use.

F. D.I.S.S. Suction Service Connections:

1. Inlets complying with CGA V-5.
2. Threaded indexing to prevent interchange between services.
3. Constructed to permit one-handed connection and removal of equipment.
4. Medical Vacuum: CGA V-5, D.I.S.S. No. 1220.

G. Vacuum Bottle Brackets: One piece, with pattern and finish matching corresponding service cover plate.

H. Cover Plates:

1. One piece.
2. Aluminum or stainless steel.
3. Permanent, color-coded, identifying label matching corresponding service.

2.6 NITROGEN

A. Comply with USP 32 - NF 27 for oil-free dry nitrogen.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing is not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction perform the following procedures:

1. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1.
2. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb (0.453 kg) of chemical to 3 gal. (11.3 L) of water.

   a. Scrub to ensure complete cleaning.
   b. Rinse with clean, hot water to remove cleaning solution.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of vacuum piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, vacuum producer sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Comply with NFPA 99 for installation of vacuum piping.

C. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.

F. Install piping adjacent to equipment and specialties to allow service and maintenance.

G. Install vacuum piping with 1 percent slope downward in direction of flow.

H. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than piping pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.

I. Install eccentric reducers, if available, where vacuum piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

J. Provide drain leg and drain trap at end of each main and branch and at low points.

K. Install thermometer and vacuum gage on inlet piping to each vacuum producer and on each receiver and separator.

L. Install piping to permit valve servicing.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and for branch connections. Extruded-tee branch outlets in copper tubing may be made where specified.

O. Install medical vacuum piping from medical vacuum service connections specified in this Section, to equipment specified on the drawings.

P. Install medical vacuum service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.

Q. Install medical vacuum bottle bracket adjacent to each wall-mounted medical vacuum service connection suction inlet.

R. Connect vacuum piping to vacuum producers and to equipment requiring vacuum service.

S. Install unions in copper vacuum tubing adjacent to each valve and at final connection to each machine, specialty, and piece of equipment.

T. Install unions in PVC vacuum piping NPS 2 (DN 50) and smaller adjacent to each valve and at final connection to each machine, specialty, and piece of equipment.

U. Install flanges in PVC vacuum piping NPS 2-1/2 (DN 65) and larger adjacent to flanged valves and at final connection to each machine, specialty, and piece of equipment.

V. Install sleeves for piping penetrations of walls, ceilings, and floors.

W. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 VALVE INSTALLATION

A. Install shutoff valve at each connection to and from vacuum equipment and specialties.

B. Install check valves to maintain correct direction of vacuum flow to vacuum-producing equipment.

C. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.

D. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.

E. Install flexible pipe connectors in suction inlet piping to each vacuum producer.

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Apply appropriate tape to external pipe threads.

E. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" chapter. Do not use flux. Continuously purge joint with oil-free dry nitrogen during brazing.

F. Soldered Joints: Apply ASTM B 813, water-flushable flux to tube end. Join copper tube and fittings according to ASTM B 828.

G. PVC-to-Copper Joints: Join transition fitting PVC socket end as solvent-cemented joint to PVC pipe and join fitting end with insert to copper tube as threaded joint.

H. Extruded-Tee Outlets: Form branches in copper tube according to ASTM F 2014, with tools recommended by tube manufacturer.

I. Flanged Joints:

1. Copper Tubing: Install flange on copper tubes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
2. PVC Piping: Install PVC flange on PVC pipes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.

J. Pressure-Sealed Joints: Join copper tube and copper and copper-alloy fittings with tools recommended by fitting manufacturer.

K. Shape-Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of shape-memory-metal coupling joints.

L. Solvent-Cemented Joints: Clean and dry joining surfaces. Join PVC pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. Apply primer and join according to ASME B31.9 and ASTM D 2672 for solvent-cemented joints.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

B. Vertical Piping: MSS Type 8 or Type 42, clamps.

C. Individual, Straight, Horizontal Piping Runs:

1. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel, clevis hangers.
2. Longer Than 100 Feet (30 m): MSS Type 43, adjustable, roller hangers.

D. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for trapeze hangers.

E. Base of Vertical Piping: MSS Type 52, spring hangers.

F. Support horizontal piping within 12 inches of each fitting and coupling.

G. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch- (10-mm-) minimum rods.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
4. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
5. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
6. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.
7. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8-inch (10-mm) rod.
8. NPS 2-1/2 (DN 65): 13 feet (4 m) with 1/2-inch (13-mm) rod.
9. NPS 3 (DN 80): 14 feet (4.3 m) with 1/2-inch (13-mm) rod.

I. Install supports for vertical copper tubing every 10 feet (3 m).

J. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 (DN 25) and Smaller: 30 inches (760 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 36 inches (900 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches (1150 mm) with 1/2-inch (13-mm) rod.

K. Install supports for vertical PVC piping every 48 inches (1220 mm).

3.6 IDENTIFICATION

A. Install identifying labels and devices for laboratory vacuum piping, valves, and specialties. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

B. Install identifying labels and devices for medical vacuum piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:

1. Dental Vacuum: Black boxed letters on white-and-black diagonal stripe background.

3.7 FIELD QUALITY CONTROL FOR HEALTHCARE FACILITY MEDICAL VACUUM PIPING

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections of medical vacuum piping systems in healthcare facilities and to prepare test and inspection reports.

B. Tests and Inspections:

1. Dental Vacuum Testing Coordination: Perform tests, inspections, verifications, and certification of medical vacuum piping systems concurrently with tests, inspections, and certification of dental compressed-air piping systems.
2. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:

a. Initial blowdown.
b. Initial pressure test.
c. Cross-connection test.
d. Piping purge test.
e. Standing pressure test for vacuum systems.
f. Repair leaks and retest until no leaks exist.

3. System Verification: Perform the following tests and inspections according to NFPA 99, ASSE Standard #6020, and ASSE Standard #6030:

a. Standing pressure test.
b. Individual-pressurization cross-connection test.
c. Valve test.
d. Master and area alarm tests.
e. Piping purge test.
f. Final tie-in test.
g. Operational vacuum test.
h. Verify correct labeling of equipment and components.

4. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:

a. Inspections performed.
b. Procedures, materials, and gases used.
c. Test methods used.
d. Results of tests.

C. Remove and replace components that do not pass tests and inspections and retest as specified above.

3.8 FIELD QUALITY CONTROL FOR LABORATORY FACILITY NONMEDICAL VACUUM PIPING

A. Testing Agency: Engage a qualified testing agency to perform field tests and inspections of vacuum piping in nonmedical laboratory facilities and to prepare test and inspection reports.

B. Tests and Inspections:

1. Piping Leak Tests for Vacuum Piping: Test new and modified parts of existing piping. Cap and fill vacuum piping with oil-free, dry nitrogen. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.

    a. Test Pressure for Copper Tubing: 150 psig.
    b. Test Pressure for PVC Piping: 100 psig.

2. Repair leaks and retest until no leaks exist.
3. Inspect filters for proper operation.

C. Remove and replace components that do not pass tests and inspections and retest as specified above.

3.9 PROTECTION

A. Protect tubing from damage.

B. Retain sealing plugs in tubing, fittings, and specialties until installation.

C. Clean tubing not properly sealed, and where sealing is damaged, according to "Preparation" Article.

3.10 PIPING SCHEDULE

A. Connect new copper tubing to existing copper tubing with memory-metal couplings.

B. Connect PVC pipe to copper tube with transition fittings.

C. Flanges may be used where connection to flanged equipment is required.

D. Aboveground Dental Vacuum Piping: Use copper water tube, wrought-copper fittings, and brazed soldered joints.

E. Belowground Dental Vacuum Piping: Use schedule 80 PVC with PVC solvent joint fittings.

F. Dental Vacuum Vent/Discharge Piping: Use schedule 80 PVC with PVC solvent joint fittings.

3.11 VALVE SCHEDULE

A. Shutoff Valves:

1. Copper Tubing: Copper-alloy ball valve with manufacturer-installed ASTM B 819, copper-tube extensions.

2. PVC Piping:

    a. NPS 4 (DN 100) and Smaller: Copper-alloy ball valve with manufacturer-installed ASTM B 819, copper-tube extensions.

END OF SECTION 22 62 13

Division 23

Heating, Ventilating and Air Conditioning

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SECTION 23 01 00
GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE OF DIVISION

A. Work shall include all materials, equipment and labor necessary for a complete and properly functioning mechanical installation in accordance with all applicable codes, and contract drawings and specifications. Work shall include all work specified in Division-22, Plumbing and Division-23, HVAC.

B. Pay for all required licenses, fees, inspections and permits.

1.3 RELATION TO OTHER WORK

A. Work Not in Divisions 22 and 23: Related work not included in this division consists of requirements given in the following as may be included in the contract documents:

1. Other divisions which may include work (such as concrete, steel, painting, ceiling systems, structure and other work) related to the work of Divisions 22 and 23.

B. Work of Divisions 22 and 23: Any or all sections of Divisions 22 and 23 may include a paragraph or paragraphs under the heading, "Relation to other Work". Where such a paragraph is indicated and work directly related to the section is listed or described, such work shall be considered as relating directly to the indicated section. Any related work (directly related or otherwise) which may be omitted by reference from the "Relation to Other Work" paragraph of such section(s), shall be provided as necessary and required whether or not such work is included by reference. Such listing or description of related work within a section is given only as a convenience to the Contractor; omission of other related sections or described work does not in any way exclude the provision of such work.

C. The mechanical contractor shall coordinate with the controls vendor for all control related equipment that is provided by the controls vendor and installed by the mechanical contractor. Refer to specification 23 09 23 for list of controls vendor supplied items to be installed by the mechanical contractor.

1.4 CODES

A. Install all work in accordance with the latest edition of all applicable regulations and governing codes, including the regulations of the utility companies serving the project.

B. Where a conflict in code requirements occurs the more stringent requirement shall govern.

1.5 STANDARDS

A. All equipment and devices shall bear U.L. label, the label of an industry recognized approved testing agency or A.G.A. certification for said item of equipment or device.

B. All electrical devices must be U.L. approved.

1.6 DRAWINGS

A. Architectural and structural drawings take precedence over mechanical drawings with reference to the building construction. Mechanical drawings are diagrammatic and indicate the general arrangement and extent of work. Architectural drawings indicate more exactly the desired relationship between diffusers, registers, lighting fixtures, equipment, electric panels and devices, plumbing fixtures, and other items which remain exposed in the completed building. Exact locations and arrangement of materials and equipment shall be determined, with the acceptance of the Architect/Engineer, as work progresses to conform in the best possible manner with the surroundings and with the adjoining work of other trades. Where locations of equipment, devices or fixtures are controlled by architectural features, establish such locations by referring to dimensions on Architectural drawings and not by scaling drawings.

1.7 DISCREPANCIES

A. In case of differences between drawings and specifications, or where drawings and specifications are not clear or definite, the subject shall be referred to Architect/Engineer for clarification and instructions.

1.8 ELECTRICAL PROVISIONS

A. Work of Division 23 shall include the electrical requirements which are indicated to be integral with mechanical work and which can be summarized to include (but not necessarily be limited to) the following:

1. Motors.
2. Motor starters.
3. Furnish combination motor starters / disconnect switches for all fans that are not being provided with variable frequency drives. Combination motor starter / disconnects to be installed by electrical contractor.
4. Control switch, pilot lights, interlocks and similar devices.
5. Electrical heating coils and similar elements in mechanical equipment.
6. Electrical work specified in Division-23 for the HVAC control system.
7. Drip pans to protect electrical work.

B. Motors, Starters, Switches: Provide with all motorized mechanical equipment unless otherwise indicated.

C. Drip Pans: Where possible, do not run mechanical piping directly above electrical (or electronic) equipment which is sensitive to moisture; otherwise provide drip pans under mechanical piping. Locate pan below piping, and extend 6" on each side of piping and lengthwise 18" beyond equipment. Fabricate pans 2" deep, of reinforced sheet metal with rolled edges and soldered or welded seams; 20 gage copper, or 16 gage steel with 2 oz. zinc finish hot dipped after fabrication. Provide 3/4" copper drainage piping, properly discharged.

D. Motors: Refer to “Electric Motors, Premium Efficiency Type”.

1.9 ELECTRICAL/MECHANICAL WORK

A. Definitions: Definitions for the purpose of mechanical/electrical control and power coordination are as follows: (Note: The use of the words, "Provide", "furnish" and "install" are intended only for use in describing the coordination indicated by this paragraph and do not necessarily have the same definitions when used outside of the context of this paragraph.) Any items which do not fall within the scope of this paragraph shall be coordinated as individually specified.

1. "Furnish" means to procure an item and to deliver it to the project for installation.
2. "Install" means to determine (in coordination with others as necessary) the appropriate intended location of an item and to set and connect it in place.
3. "Provide" means to both furnish and install.
4. Power Circuit: Circuit which carries main electric power to apparatus to which the power circuit is connected.
5. Control Circuit: Circuit which carries electrical signals directing the performance of a controller but which does not carry the main electric power. (See NEC, Section 430-71.) Such circuits shall also include those which serve a dual control and power function (e.g., a line voltage thermostat circuit which both activates and powers a small fan motor).
6. Controller: A device, or group of devices, which serves to govern, in some predetermined manner, electric power delivered to apparatus to which the controller is connected and includes any switch or device normally used to start and stop a motor. (See NEC, Article 100, Definitions, "Controller", and Section 430-81(a).)
7. Control Device: A device which reacts to an operating condition (pressure, temperature, flow, humidity, etc.) and which initiates transmission of an electrical control signal which causes operation of a controller or which causes operation of pressure switches, etc.
8. Auxiliary Control Device: A device (such as a low voltage control transformer, electric relay, etc.) which is located in a control circuit and which carries or responds to (but does not initiate) an electrical control signal initiated by a control device.

B. Work of Division-23 includes (but is not necessarily limited to):

1. Provide:

a. All controllers which are generally manufactured or shipped as integral with Division-23 equipment (such as starters packaged with chillers, etc.).
b. All electric motors and other electrical power consuming equipment (such as electric air heating coils, electric boilers, electric hot water heaters, etc.) which are specified in Division 23.
c. All control circuits (including conduit and boxes) from the Division-26 panels to point of use including the necessary circuit breakers.
d. All other control circuits, including conduit and boxes.
e. All control connections to equipment.
f. All control connections to controllers, switches, motors and other mechanical systems electrical power consuming equipment (such as electric air heating coils, electric boilers, electric hot water heaters, etc.).
g. Auxiliary control devices.
h. All control devices (thermostats, pressure switches, flow switches, humidistats, etc.) and make control circuit connections thereto.
i. Any and all pneumatic and electronic and electric control devices and electric or pneumatic connections thereto.

2. Furnish:

    a. All controllers which are generally manufactured and/or shipped as separate but companion items to Division-23 equipment (such as centrifugal chiller starters which are matched with the chillers but are not physically an integral part of the chiller assembly.)

C. Work of Division-26 includes (but is not necessarily limited to):

1. Provide:

    a. All power circuits, including conduit and boxes.
    b. All power connections to controllers, switches, motors and other mechanical systems electrical power consuming equipment (such as electric air heating coils, electric boilers, electric hot water heaters, etc.).
    c. All remote motor disconnects (remote from the related controller) at all locations required by NEC and connections thereto except those disconnects which are specified in Division-23 to be provided as part of the equipment itself.
    d. All controllers (except those which are generally manufactured or shipped as separate but companion items to Division-23 equipment such as centrifugal chiller starters).

2. Install:

    a. All controllers which are generally manufactured and/or shipped as separate but companion items to Division-23 equipment (e.g., chiller starters).

1.10 AUXILIARIES AND ACCESSORIES

A. Include all auxiliaries and accessories for complete and properly operating systems.

1.11 INVESTIGATION OF SITE

A. Check site and existing conditions thoroughly before bidding. Advise Architect/Engineer of discrepancies or questions noted before bidding.

1.12 ASBESTOS

A. Should asbestos, or any other hazardous waste material, be encountered during the execution of the work, or should the presence of asbestos or any other hazardous material be suspected, immediately notify the Owner and suspend all work in the affected area. The Owner will activate an assessment study to determine the presence of asbestos, or other hazardous material, and evaluate what condition it is in. Removal of asbestos, or other hazardous material, if required, will be conducted by a qualified Contractor, and will be done under separate contract.

1.13 COORDINATION

A. Provide all required coordination and supervision where work of this division connects to or is affected by work of others.

1.14 PROVISIONS FOR OPENINGS

A. Provide all openings required for work performed under Division-23. Provide sleeves or other approved methods to allow passage of items installed under any Section of Division-23.

1.15 INTERRUPTION OF EXISTING SERVICES

A. Any interruption of existing services shall be coordinated in advance with the Owner's Representative. Shutdown time and duration of critical services shall be decided by the Owner. Contractor shall provide shutoff valves at point of tie-in to minimize downtime.

1.16 CLEANING AND PROTECTION

A. Ductwork: Keep the interior of the duct system free from dirt and rubbish and other foreign matter. All fan motors, switches, and other items, shall also be protected from dirt, rubbish and other foreign matter during building construction. Thoroughly clean all components of the ductwork and remove all dirt, scale, oil and other foreign substances which may have accumulated during the installation process.

B. Equipment: All mechanical equipment provided shall be thoroughly cleaned of all dirt, oil, concrete, etc. Any dents, scratches or other visible blemishes shall be corrected and the appearance of the equipment made "like new" and to the satisfaction of the Architect/Engineer.

C. Upon completion, and before final acceptance of the work, all debris, rubbish, leftover materials, tools and equipment shall be removed from the site.

D. Protection of Work Until Final Acceptance: Protect all materials and equipment from damage, entrance of dirt and construction debris from the time of installation until final acceptance. Any materials and equipment which are damaged shall be repaired to "as new" condition or replaced at the direction of the Architect/Engineer. Where factory finishes occur and damage is minor, finishes may be touched up. If, in the opinion of the Architect/Engineer the damage is excessive, factory finish shall be replaced to "new" condition.

1.17 SHOP DRAWINGS

A. Submit shop drawings for all items, services and systems included in the project.

B. Shop drawings shall clearly show the following:

1. Technical and descriptive data in detail equal to or greater than the data given in the item specification. Indicate all characteristics, special modifications and features. Where performance and characteristic data is shown on the drawings or specified, submitted data shall be provided in a degree which is both quantitatively and qualitatively equal to that specified and shown so that comparison can be made. Present data in detail equal to or greater than that given in item specification and include all weights, deflections, speeds, velocities, pressure drops, operating temperatures, operating curves, temperature ranges, sound ratings, dimensions, sizes, manufacturers' names, model numbers, types of material used, operating pressures, full load amperages, starting amperages, fouling factors, capacities, set points, chemical compositions, certifications and endorsements, operating voltages, thicknesses, gauges and all other related information as applicable to particular item.

2. Exceptions to or deviations from the contract documents. Should Architect/Engineer accept any items having such deviations which are not clearly brought to Architect/Engineer's attention, in writing, on item submittal, then Contractor is responsible for correction of such deviations regardless of when such deviations are discovered.

C. Additional Requirements: See specific sections of the Specifications for any additional requirements.

1.18 SHOP DRAWINGS TECHNICAL INFORMATION SUBMITTALS

A. All submittals are to be submitted electronically in the form of PDF. Electronic submittal file names must be formatted with the specification section number followed by the title of the specification section. One file shall be provided for each specification section that requires submittals to be provided.

B. A cover page shall have adequate space for Contractor, Subcontractor and Engineer review stamps and indicate the following minimum data:

1. Project Name
2. Project Address
3. Contractor Name
4. Subcontractor Name
5. Specification Section Number
6. Specification Section Name
7. Submittal Date

C. All shop drawings and equipment submittals shall be submitted complete based on specification division. Partial submittals of each specification section will not be accepted.

D. All submittals shall have been reviewed for compliance Contractor and associated subcontractor prior to submission to the Engineer. A stamp bearing the name of the reviewer and date review was completed shall be on the cover page of the submittal.

E. Submittal data shall be logically grouped based on equipment tags or like material. For submittals that contain data on multiple materials or equipment, it shall be clearly noted by equipment tag or applicable material.

F. Manufacturer’s data indicating multiple options or choices shall be clearly noted as to what is applicable to the material and equipment being provided. Information not applicable should be struck through or extracted.

1.19 SHOP DRAWINGS FOR PIPING SYSTEMS AND DUCT SYSTEMS

A. Shop drawings for piping systems and duct systems shall be performed by the installing subcontractors. Shop drawings shall show all required maintenance and operational clearances required. Title drawings shall include identification of project and names of Architect, Engineer, Contractor, subcontractor and/or supplier, date, be numbered sequentially and shall indicate the following:

1. Architectural and structural backgrounds with room names and numbers, etc., including but not limited to plans, sections, elevations, details, etc.

a. Fabrication and Erection dimensions.

b. Arrangements and sectional views.
c. Necessary details, including complete information for making connections with other work.
d. Kinds of materials and finishes.
e. Descriptive names of equipment.
f. Modifications and options to standard equipment required by the contract.

B. Also provide shop drawings, using architectural reflected ceiling plans, which indicate locations of the following (to be verified by Contractor): Air distribution devices, sprinkler heads, lights, access panels, fire alarm, speakers, projectors or any system device intended to be installed in the ceiling.

C. See specific sections of specifications for further requirements.

1.20 AIR HANDLING UNIT AND DUCTWORK CONFIGURATION SHOP DRAWINGS

A. Contractor shall submit a shop drawing for all system and shall meet the following requirements:

1. Be drawn at not less than a scale of 1/4" = 1'-0". Contractor may elect to use a larger scale if he desires (i.e., if drawing of unit is at 1/4" = 1'-0", 1/2" = 1'-0" may be used.).
2. Clearly show all proposed ductwork configuration changes (sizes, routing, and similar differences) which are different in any respect from the Drawings.
3. Where proposed changes affect any other work such as structure, housekeeping pads, piping, equipment, electrical work or any other work, shop drawings shall clearly show those proposed changes.
4. Where Drawings show units in plan only, shop drawings shall show proposed units in plan and also in elevation.
5. Shop drawings shall also show exact locations of related work (such as bar joists, columns, beams, sound attenuators, and like items) which affect the proposed ductwork routing and unit location and configuration.
6. Each section of each air handling unit shall be clearly identified (i.e., coil section, fan section, filter section, mixing box section, etc.).

B. Failure to submit these shop drawings together at the same time with the air handling unit shop drawings will result in total disapproval of the proposed air handling units. Time delays or other reasons will not be considered.

1.21 ELECTRONIC FILES

A. CADD files will be available on a limited basis to qualified firms at the Architects prerogative. Recipients are cautioned that these files may not accurately show actual conditions as constructed. Users are responsible to verify actual field conditions. These files are not intended to be used as shop drawings.

1.22 OPERATING INSTRUCTIONS

A. Submit for checking a specific set of written operating instructions on each item which requires instructions to operate. After acceptance, insert information in each Technical Information Brochure. Refer also to other sections which may describe operating instructions.

1.23 MAINTENANCE INFORMATION

A. Submit for acceptance Maintenance Information consisting of manufacturer's printed instruction and parts lists for each major item of equipment. After acceptance, insert information in each Technical Information Brochure. Refer also to other sections which may describe maintenance.

1.24 MANUFACTURER'S CHECK-OUT

A. Check out by Manufacturer's Representative (for major items of equipment): At completion of construction and after performance verification information as above-mentioned has been gathered, submitted and accepted, provide one copy of this information to the manufacturer's representative. Work required under this section shall include having the representative examine the performance verification information, check the equipment in the field while it is operating, and sign a Check-Out Memo for record. Submit a copy of the memo on each major item of equipment for each brochure. Accepted memos shall be inserted on each brochure with the performance verification information and submittal data. Memos shall be submitted and accepted before Instruction in Operation to Owner or a request for final inspection.

1.25 SYSTEM GUARANTEE

A. The work required under Division-23 shall include a one year guarantee. This guarantee shall be by the Contractor to the Owner to replace for the Owner any defective workmanship, equipment, or material which has been furnished under this Contract at no cost to the Owner for a period of one year from the date of acceptance of the System. This guarantee shall also include reasonable adjustments of the system required for proper operation during the guarantee period. Explain the provisions of guarantee to Owner at the "Instruction in Operation Conference".

1.26 INSTRUCTION TO OWNER

A. Submit all required items for checking one week before final inspection of the building is scheduled. When all items are accepted and placed in the proper brochures, the Contractor shall give notice in writing that he is ready to give the Owner an "Instruction in Operation Conference". After the above mentioned request is received the Contractor will be notified of the time the conference can be held with the Owner. At the conference, the Contractor shall review with the Owner all appropriate information. At the end of the conference, seven copies of a memo certifying Instruction in Operation and Completed Demonstration shall be signed by the Contractor, Subcontractor and Owner and one copy inserted in each brochure.

1.27 MATERIALS AND EQUIPMENT

A. Each bidder represents that his bid is based upon the materials and equipment described in this division of the specifications.

1. Submittal shall include the name of the material or equipment for which it is to be substituted, substituted equipment model numbers, drawings, cuts, performance and test data and any other data or information necessary for the Architect/Engineer to determine that the equipment meets all specification and requirements. If the Architect/Engineer accepts any proposed substitutions, such acceptance will be set forth in writing.

2. Substituted equipment with all accessories installed or optional equipment where permitted and accepted, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether accepted or not, shall be replaced at the Contractor's expense. Any modifications of related systems of this or other trades as a result of substitutions shall be made at the Contractor's expense, and Contractor shall so state in his written request for substitution.

B. Acceptable Manufacturers: Materials and Equipment specified in these contract documents are accepted only in regards to general performance and quality. It shall be the Contractor's responsibility to insure that acceptable materials and equipment meet or exceed the efficiencies, capacities, electrical characteristics, performance and quality of the equipment herein specified. Acceptable equipment must also generally conform, without extensive modification of related systems to the accessories, weights, space and maintenance requirements, etc., of the specified equipment. Any modification to related systems of this or other trades shall be made at the Contractor's expense and the Contractor shall be responsible for coordination between trades. Any difference in capacity, efficiency, electrical characteristics, weights or quality of product, etc., between specified materials and equipment and acceptable alternates shall be submitted to the Architect/Engineer for acceptance within 30 days of Notice to Proceed.

C. If no prior approval for substitutions or alternate manufacturers have been provided, the bid must conform with the requirements of the plans and specifications. No equipment substitutions or alternate manufacturers will be considered once the project bidding has ended.

PART 2 - PRODUCTS

2.1 Section part not applicable.

PART 3 - EXECUTION

3.1 Section part not applicable.

END OF SECTION 23 01 00

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SECTION 23 05 00
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section, in addition to the following:

1.2 SCOPE

A. Materials listed herein are general mechanical materials to be used under the Division 23 sections of the specifications unless specifically noted otherwise in the particular section or on the drawings.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications. This section relates to all sections of Division 23 as may be applicable to the work of each section.

1.4 STANDARDS

A. Quality and weight of materials shall comply with requirements and specifications of the appropriate standards of the American Society of Testing and Materials.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT, GENERAL

A. All materials and equipment shall be new and without blemish or defect.

B. Equipment and materials shall be products which will meet with the acceptance of the agency inspecting the work. Where acceptance is contingent upon having the products examined, tested and certified by Underwriters Laboratory or other recognized testing laboratory, the product shall be so examined, tested and certified.

C. Where no specific indication as to the type or quality of material or equipment is indicated, a standard item or system shall be furnished with all options, features and capabilities to meet the project requirements.

D. Performance and Capacity:

1. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In some cases equipment may be sized to allow for future requirements or for other reasons which may not be stated on the Drawings or in the Specifications; provide equipment and systems with the capacities, capabilities and features indicated to provide the maximum or minimum (as appropriate) conditions.

E. Operating conditions and capacities must be as follows:

1. No overloading.
2. No operation at conditions outside of maximum and minimum limits recommended by the manufacturer and accepted by the Architect/Engineer.
3. Compatible with all systems.

F. Unless otherwise specified, all equipment and materials furnished must be as follows:

1. Recommended by the manufacturer for the application.
2. Installed in accordance with the manufacturer's recommendations for the application except where specifications and drawings clearly indicate otherwise.

2.2 ACCESS DOORS AND PANELS

A. Locations: Provide access doors and panels (access units) as necessary for access to items which are concealed and which may require service or maintenance or other reason for accessibility. Examples of such items include, but are not limited to, the following: valves, cleanouts, pipe unions, expansion joints and connectors, dampers, coils, junction boxes, duct heaters, terminal units, HVAC control system devices and similar types of items.

B. Access units: Shall be manufactured by the Milcor Division of Inland-Ryerson, Boico, Nystrom or Ventfabrics. Types are as follows (Milcor style designations are used for example only):

Location	Door/Panel Type
Drywall	Style "DW"
Masonry or tile	Style "M-stainless"
Acoustical tile	Style "AT"
Plaster	Style "K"
Fire-rated walls (**or as indicated below)	Style "Fire Rated"**

C. Fire Rated Units:

1. Frame and panel assembly shall bear a U.L. label reading, "frame and door assembly, rating 1-1/2-hour (B), temperature rise 30 minutes 250^{o}F maximum".
2. Have an automatic closing device and mechanism to release the latch bolt from the inside.
3. Acceptable Manufacturers: Boico Style F, Inryco/Milcor Style VA, Nystrom Style APFR.

D. Non-fire Rated Units:

1. Steel panels and frames.
2. Locks and latches shall be as appropriate for the location and shall be cam-lock type latches, flush screw driver operated locks or cylindrical locks.

3. Provide two keys for all doors. All doors shall be keyed the same.

E. Other Requirements:

1. Doors and panels installed in glazed or ceramic tiled surfaces, in toilet rooms or in kitchens shall be stainless steel.
2. Unless otherwise indicated, finish shall be rust inhibitive prime coat.

F. Sizes:

1. Minimum size: 8" x 8".
2. Sizes of each unit shall be individually selected to allow the recommended and required service and maintenance and accessibility functions to be accomplished. These functions shall generally include, for example, valve removal, damper linkage resetting, control adjustment, lubrication, repair, replacement and similar tasks as may be necessary and recommended for the concealed item.
3. Sizes shall be of the following increments (unless otherwise approved) to allow the accessibility function to be accomplished: 8" x 8", 8" x 12", 12" x 12", 12" x 16", 16" x 16", 16" x 24", 24" x 24", 24" x 36", 30" x 30", 36" x 36" or 36" x 48".
4. No size smaller than 16" x 24" shall be allowed when a person must pass through the access opening in order to accomplish the desired accessibility function.
5. Every attic or furred space in which mechanical equipment is installed shall be accessible by an opening and passageway as large as the largest piece of the equipment and in no case less than 22 x 36 inches continuous from the opening to the equipment and its controls. The opening to the passageway shall be located not more than 20 feet from the equipment measured along the center line of such passageway.

2.3 PAINTING AND MARKING

A. All paint and materials used for painting shall be manufacturer's "first quality" product. For additional paint material requirements, refer to Section 09 91 01, Painting.

B. Marking: Refer also to sections describing identification of mechanical systems.

2.4 PIPE HANGERS AND SUPPORTING DEVICES

A. General: Refer to other sections of Division 23 for any requirements which may be additional to this section. Comply with the more stringent requirement if more than one method is specified or shown.

B. Pipe supporting devices specified herein shall apply to all Division 23 piping unless modified in subsequent sections of Division 23 (i.e., vibration isolation) or detailed on the drawings.

1. Pipe hangers for copper pipe shall be copper or copperplated and for steel pipe shall be zinc-plated, clevis type hangers.
2. Hangers for pressure piping shall be clevis type or accepted as equivalent. Pipe hangers shall be capable of vertical adjustment after erection of the piping. Piping shall not be hung from fire and/or smoke walls.
3. Vertical piping supports shall be constructed of carbon steel with rounded ears and two or four holes for clamping bolts. Steel, galvanized and cast iron piping riser clamps shall have galvanized finish. Copper and brass piping riser clamps shall have electro-plated copper or PVC coating finish.

4. Acceptable Manufacturers are Grinnell, PHD Manufacturing Inc., Fee and Mason, Michigan and Elcen.

C. Beam clamps may be used when supporting piping from steel structures.

D. Concrete inserts shall be placed in forms as work of Division 23 prior to the time that concrete is poured.

E. Lead tamp-ins may be used when installed in a concrete or masonry wall or other like vertical surface to support a vertical hanger. Lead tamp-ins will not be permitted to support hangers to the underside of a concrete slab.

F. For parallel runs of above ground suspended piping, an acceptable trapeze-type hanger may be used. Provide permanent, non-conductive type wrapping between copper pipe and steel trapeze hangers.

G. Powder set type fasteners or inserts shall not be used.

2.5 FLOOR, WALL OR CEILING PLATES OR ESCUTCHEONS IN EXPOSED AREAS

A. Shall be chrome-plated. Escutcheons for extended sleeves shall be of the type designed for that purpose. Split ring escutcheons will not be allowed.

B. Escutcheons to be as manufactured by Guarantee Specialty Mfg. Co., Cleveland, Ohio; American Sanitary Mfg. Co., Abingdon, Ill., or Beaton Cadwell.

C. Provide escutcheons or fabricated plates or collars at each location where pipe or duct passes through a finished surface. Escutcheons for flush sleeves shall be equivalent to Benton & Caldwell No. 3A chromium plated brass; for sleeves extending above floor shall be equivalent to Benton & Caldwell No. 36 chrome plated brass. Collars or plates for ducts and large diameter insulated pipe shall be fabricated of 18 gage galvanized copper bearing sheet steel, secured to structure and neatly fitted around duct or pipe.

2.6 SLEEVES

A. General: Lay out work and set sleeves in new or existing construction so there shall be minimum of cutting, drilling and patching. All sleeves not used during construction period shall be sealed using grout. Unused penetrations or sleeves through fire rated barriers shall be sealed to prevent passage of smoke or heat using an Underwriters' Laboratories approved method rated at least equivalent to the barrier being penetrated. Method submitted must show proof of UL approval.

B. Pipe Sleeves: Except where specified otherwise below, pipe sleeves shall be as follows:

1. Sleeves installed in walls subject to hydrostatic (water) pressures shall be "link seal" (Thunderline Corp) Type WS or accepted as equivalent.
2. When there is piping existing, and fire rated walls are to be erected, Proset fire rated split wall system pipe sleeves, or accepted equivalent, are to be used.
3. When copper or steel slab penetrations are required, use Proset System A, or accepted as equivalent for fire-rated and water pipe installations.

C. Walls and Partitions:

1. Sleeves 8-Inch Diameter and Smaller (Above Grade): Sleeves shall be mild steel pipe or plastic sleeves built into wall, partition or beam, sized to pass pipe and covering, leaving a clear space of 1/4-inch minimum between covering and sleeve. Penetrations of fire rated barriers shall have mild steel sleeves.
2. Sleeves Installed in Exterior Walls (Below Grade): Schedule 40 steel hot dipped galvanized after fabrication or cast iron sleeve with 1/4-inch x 3-inch center flange (water stop) around the outside.

D. Floors (Above Grade): Sleeves shall be Schedule 10 galvanized steel, set before floor is poured, sized to pass pipe and covering, leaving a clear space of 1/4-inch between covering and sleeve, and shall extend ½-inch above finished floor.

E. Duct Sleeves: Sleeves or openings sized to pass mechanical ducts and covering shall be of framed construction in roof, wall, or partitions.

F. Sealing of Sleeves:

1. Sleeves Below Grade: Caulk annular space between pipe and sleeve using oakum and poured lead both sides minimum one inch deep to make wall penetration water tight.
2. Sleeves Above Grade: Openings around pipes, duct, etc., passing through sleeves shall be made draft free and vermin-proof by packing solidly with mineral wool or fiberglass.
3. Sealing of Sleeves Through Fire Rated Barriers: All penetrations through fire rated barriers shall comply with Division-07 or as specified in this Division.

2.7 FIRE/SMOKE RATED FLOOR, PARTITION OR WALL PENETRATION SEALANT

A. Seal shall be composed of fire barrier product, putty, or caulking materials used either in combination or singularly. Acceptable Manufacturers are 3M Corporation or Dow Corning.

2.8 EXCAVATION AND BACKFILL

A. Provide as necessary to accomplish work specified. Perform in accordance with applicable State and Local codes and accepted good practice and in accordance with other applicable sections or divisions.

2.9 BELT DRIVES

A. General: Equip each motor driven machine not direct connected with V-belt drive. Belts shall be of correct cross section to fit properly in sheave grooves and shall be carefully matched for each drive. Sheaves shall be cast iron or steel, bored to fit properly on shafts and secured with keys of proper size. The rating of each drive shall be as recommended by manufacturer for service but shall be at least 1.5 times nameplate rating of motor.

B. Speed Adjustment: Adjust fan speed by change(s) in sheave size as necessary to obtain proper design air flow with fan in its installed location. Fans may be first fitted with variable pitch drives until proper speed adjustment is made and then fitted with proper fixed pitch drive size, or alternate sizes of fixed pitch drives may be used until proper fan needed to deliver necessary air quantity.

C. Vibration of Air Handling Equipment and Fan Units: For air handling equipment and fans driven by motors 5-hp or greater, field vibration levels will not be acceptable if the maximum vibration velocity or displacement measurement exceeds the following values (when measurements are taken at the bearing supports using a vibration analyzer with the filter set at the operating fan speed):

Fan Speed (RPM)	Maximum Vibration Level
800 or Less	5 Mils (0.127 mm) max. displacement
801 and Greater	0.20 in/sec. (5 mm/s) max. velocity

D. Belt and Coupling Guards: Each belt drive shall be equipped with an OSHA approved guard. Guards shall be constructed of #12 U.S. standard gage 3/4-inch diamond mesh wire screen, or equivalent, welded to one inch steel angle frames, and shall enclose all belts and sheaves. Tops and bottoms of guards shall be of substantial sheet metal or not less than #18 U.S. standard gage. Braces or supports must not "bridge" sound and vibration isolators. Guards shall be designed with adequate provision for movement of motor required to adjust belt tension. Means shall also be provided to permit oiling, use of speed counters, and other maintenance and testing operations with guard in place. All direct drive equipment shall have coupling guards in accordance with Florida Department of Business Regulation safety regulations and OSHA.

2.10 BEARINGS

A. All bearings shall be 200,000-hour rated unless otherwise specified.

PART 3 - EXECUTION

3.1 EQUIPMENT ACCESS

A. Access Doors and Panels:

1. Locations: Provide access unit at the following locations.

   a. Where additionally specified in other sections of this Division 23 and where specifically indicated on the drawings.
   b. Where not specifically indicated on the drawings but where the work to be provided will require accessibility for purposes as described or as recommended by the manufacturer of the concealed item.
   c. At all locations where concealed equipment, fixtures, devices and similar items require accessibility for service, inspection, maintenance, repair, replacement and where such concealed item would not otherwise be accessible for such functions without the provision of an appropriately sized access unit.

B. Installation:

1. Definitions: For the purpose of coordination of responsibility, the following words are defined to describe the intended coordination.

   a. "Furnish" means to procure an item and deliver it to the project for installation.

b. "Install" means to determine (in coordination with others as necessary) the intended appropriate location of an item and to set, connect and otherwise fix in place in a manner to allow intended operation and use.
c. "Provide" means to both furnish and install fully and completely in all aspects.

2. Furnishing Access Units: Access units shall be furnished as work of the Division which governs the item which is intended to be made accessible by the access unit.
3. Installing Access Units: Access units shall be installed as work of the Division which governs the surface, barrier, partition or other building component in and on which the access unit is to be placed.
4. Determination of Locations:

a. Where the work of Division 23 requires that the access unit be provided (i.e., both furnished and installed), then the responsibility for determination of the location at which the access unit is to be placed is also work of Division 23.
b. Where the work of Division 23 requires that access unit be furnished for installation as work of another Division, then the responsibility for determination of the location at which the access unit is to be installed shall be work of Division 23. Conversely, where the work of one Division requires that an access unit be only installed, then the responsibility for determination of the location of which the access unit is to be installed shall be work of Division 23 which furnishes the access unit.

5. Determination of Sizes:

a. Unless an access unit size is indicated on the drawings or otherwise specified, the size of each access unit shall be determined as work of the Division which either provides or furnishes the access unit.
b. Sizes for access units which are provided or furnished as work of this Division shall be in compliance with sizing criteria of this Division.

3.2 PAINTING

A. Paint all exposed piping, insulation, equipment, structural bases, racks, in equipment rooms and on roof, furnished under Division 23 of these specifications. All exposed metal surfaces shall be given one prime coat and two finish coats. All insulated surfaces shall be given one sizing coat of glue sizing (omit this step if factory applied finish is suitable to receive prime coat), one prime coat and one finish coat. Factory painted or finished items do not require field painting but shall require "touch-up" with matching paint or finish where scratched.

B. Pipe hangers, saddles, supports, riser clamps and accessories shall be painted to match their piping.

C. Equipment not completely accessible for painting when set in place shall be thoroughly cleaned and painted before installation and suitably protected.

D. Piping concealed need not be painted.

3.3 HANGERS AND INSERTS

A. Refer also to other sections which may describe additional requirements for hanging and supporting. Comply with the more stringent requirement if more than one method is specified or shown.

B. Provide and properly locate hangers to adequately support piping and equipment. Arrange hangers to permit expansion and contraction.

C. The size of hanger for non-insulated pipes shall be suitable for pipe size to be supported. For insulated piping, the size of the hanger shall be suitable for the pipe size, plus the insulation and a 16-gauge half-circle galvanized sheet metal insulation saddle.

D. Isolation of copper pipe from steel hangers to consist of wrapping pipe at, and 1" each side of contact surface with not less than two layers of adhesive type plastic electrical insulating tape.

E. Pipe supports for piping 2" diameter and below may be supported directly from Epicure steel decking using Epicure standard hangers (200 lb. max. load). Piping above 2" shall be supported from steel beams.

F. Locate pipe supports as follows unless noted in other sections of these specifications or on the drawings:

1. Horizontal cast iron pipe inside building - supported on each length of pipe.
2. Vertical cast iron pipe inside building - supported at each floor level and at the base.
3. Horizontal steel piping and copper tubing 1" diameter and under - support on 6' centers.
4. Horizontal steel piping and copper tubing above 1" through 1-1/2" diameter - support on 8' centers.
5. Horizontal steel piping and copper tubing larger than 1-1/2" diameter -support on 10' centers, except 24" diameter piping shall be supported by main roof beams (20' O.C. maximum).
6. Support vertical cast iron, steel and copper piping at each floor penetration not to exceed 20 foot intervals.

3.4 ANCHORS

A. Install a suitable anchor on piping to prevent movement from expansion and contraction by welding or clamping securely to pipe at fitting or coupling. Approval of the Engineer of method of anchorage must be obtained before installation of work. Properly anchor piping to remove strains on equipment which would be caused by expansion and contraction. Adequately insulate anchors on piping, with operating fluid temperatures below 75°F, to prevent moisture condensation problems.

3.5 EXPANSION AND CONTRACTION PROVISIONS

A. Piping is designed with offsets and loops to provide for expansion and contraction. At such points, piping shall be cold sprung to equalize expansion when at operating temperatures. Install piping to maintain grade at all operating temperatures.

3.6 FLASHING

A. Flashing shall be done as work of other divisions.

3.7 PIPING SLEEVES

A. Contractor shall furnish and set sleeves for his piping. Use galvanized sheet steel with water tight seams and joints or pipe for poured concrete. Extend sleeves thru walls, partitions and ceilings to finished surface. Extend sleeves 1/4 inch above finished concrete floors and 1 inch above slab in chases. Sleeves, installed above finished ceilings, for fire/smoke rated wall assemblies shall extend 1" beyond each face of wall.

B. Adequately size sleeves to permit clearance for pipe movement and proper grading of pipes. Sleeves for insulated pipe shall be of adequate size to clear insulation.

C. Caulk space between insulation or pipe and sleeve with asbestos rope and seal with fire rated safing material (or flexible fire retardant sealant if pipe is subject to expansion or contraction) to serve as a fire and smoke stop.

D. Sleeves in walls and/or slabs subject to hydrostatic pressures shall be made water tight.

3.8 ESCUTCHEONS

A. Provide chrome plated brass escutcheons (for 1/4 or 1 inch projecting sleeves as required) at each point where an uninsulated pipe passes thru a finished surface.

3.9 CONCRETE BASES AND STRUCTURAL STEEL

A. Concrete bases and structural steel to support equipment and piping installed under each specification section or division and not specifically shown on the structural or architectural plans shall be furnished for this work.

3.10 SEALANT

A. Fire/smoke sealant shall be installed in strict compliance with the manufacturer's installation instructions.

END OF SECTION 23 05 00

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SECTION 23 05 13
ELECTRIC MOTORS, PREMIUM EFFICIENCY TYPE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Division 26 – Electrical.

1.2 SCOPE

A. This Section describes electric motors which are higher efficiency. These motors require less energy than standard electric motors which do not meet this specification.

B. This specification covers 3/4 HP or larger horizontal, 3 phase, integral horsepower, drip proof, squirrel cage induction motors in the NEMA frame sizes through 449.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications.

1.4 STANDARDS

A. All motors shall be in accordance with the latest version of NEMA Standard MG-1. Motors shall also comply with the applicable portions of the National Electric Code.

1.5 SUBMITTALS

A. Independent motor submittals for motors that are part of air handling unit or pumping equipment shall be provided for all motors 1 HP or greater.

PART 2 - PRODUCTS

2.1 VOLTAGE FREQUENCY

A. Motors through 100 hp shall be rated 230/460 volts with 200 or 575 volts as optional; motors above 100 hp shall be rated 460 volts with 575 volts as optional. Motors will be rated for operation on a 3 phase, 60 Hertz power supply. Refer to Electrical Drawings.

2.2 COORDINATION

A. Where variable frequency drives are used to vary the speed and power consumption of electric motors, such motors must be high efficiency type and must be considered with the actual variable frequency drives which are provided so that optimum matching of variable frequency drive to driven motor is obtained.

2.3 OPERATING CHARACTERISTICS

A. Torques: Motors shall meet or exceed the locked rotor (starting) and minimum breakdown torques specified in NEMA standards for Design B for the ratings specified.

B. Currents: Locked rotor (starting) currents shall not exceed NEMA Design B maximum values for the specified rating. Motors shall be capable of a 20 second stall at six times full load current without injurious heating to the motor components.

C. Efficiency: Motors shall have full load efficiency which will meet or exceed the values for NEMA Premium® efficiency motors as listed in NEMA 1-2006, Table 12-12 when tested in accordance with NEMA test standard MG1-12.53a, IEEE Test Procedure 112, Method B, using accuracy improvement by segregated loss determination including stray load loss measurements. The minimum efficiency shall be guaranteed.

2.4 SERVICE FACTOR AND AMBIENT

A. Motors shall be rated for a 1.15 service factor in a 40^{o}C ambient.

2.5 INSULATION

A. For constant speed application motors, provide full Class B insulation system.

B. For motors with variable frequency drive, provide with Class F insulation suitable for operation down to 10%.

2.6 FRAME SIZE

A. Horsepower/frame relationship shall conform to the latest NEMA Standard for T frame motors.

2.7 ENCLOSURE

A. Motors shall be drip proof construction.

B. Motor frame and endshields shall be of cast aluminum construction using alloys with low copper content.

2.8 BEARINGS

A. All motors shall have anti-friction bearings, sized for a L-10 life of at least 125,000 hours L-10 life for a direct connected load.

B. Aluminum endshields shall have a cast-in steel or cast iron bearing insert.

C. Bearing housing shall be regreasable with provisions for purging old grease.

D. Bearings shall be preloaded with a bearing loading spring to minimize noise and increase bearing life.

2.9 OTHER REQUIREMENTS

A. Conduit Box shall be diagonally split and rotatable in 90 degree increments.

B. External hardware shall be plated to resist corrosion.

C. External paint shall withstand industrial environments.

D. Nameplates shall be of stainless steel or aluminum and stamped per NEMA Standard MG1-10.37. Nameplate information shall include the nominal efficiency value per Standard MG1-12.53b and the manufacturer's minimum guaranteed efficiency value.

2.10 SHOP DRAWINGS

A. In addition to shop drawing requirements of the section entitled, "General Mechanical Provisions", provide motor data including horsepower; rpm; frame size; nominal efficiency and nominal power factor at full load, 75% load and 50% load; guaranteed efficiency and guaranteed power factor at full load, 75% load and 50% load.

PART 3 - EXECUTION

3.1 MOTOR LOCATIONS

A. Provide NEMA Premium® efficiency motors for the following as provided on this project:

1. Motors for pumps.
2. Motors for AHU fans.
3. Motors for cooling tower fans.

END OF SECTION 23 05 13

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SECTION 23 05 15
INSTRUCTIONS AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide complete written and verbal operating and maintenance instruction to the Owner for all mechanical systems.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

B. This section directly relates in particular to sections which describe the following:

1. Valves and piping systems components requiring maintenance and which are involved in the dynamic function of the systems.
2. Pumps and related flow devices.
3. Plumbing equipment (heat exchangers, packaged systems, etc.)
4. HVAC equipment (all air handling equipment, terminal units, filter assemblies, etc).
5. Control systems.

PART 2 - PRODUCTS

2.1 INSTRUCTIONS AND MAINTENANCE MANUALS

A. Provide Maintenance Manuals in PDF format as follows:

1. Title sheet with job name, Contractor's, subcontractor's control subcontractor and related contractor's or material supplier's names, addresses and phone numbers.
2. Index of contents.
3. A signed copy of acknowledgment of instructions to the Owner or his authorized representative. Two additional copies of the signed acknowledgment shall be sent directly to the Architect as soon as possible after receipt.
4. Operating instructions for the Owner's personnel describing the following for each piece of equipment and systems:

    a. How to start and stop each piece of equipment.
    b. How to set equipment and systems for normal operation.
    c. Normal restarting procedures before contacting the service contractor.

d. Complete description of functions and operations of each piece of equipment including description of how equipment operates in conjunction with automatic control systems.
e. Instructions for cleaning, oiling, greasing, fueling and similar tasks.

5. Approved shop drawings and submittal data and parts and maintenance booklet for each item of material and equipment furnished under this Division, including (but not limited to) the following:

   a. Spare parts list and source of supply for each equipment item.
   b. List of valves with location, service, size, model and operating position.
   c. Diagrams clearly indicating automatic control hook-up.

6. Any as-built wiring diagrams as called for in other sections of this division as needed to show how equipment controls interface with related systems.
7. Copies of certificates of inspection.
8. Guarantees.

PART 3 - EXECUTION

3.1 VERBAL INSTRUCTION

A. Provide verbal, hands-on, operating and maintenance instruction to Owner's authorized personnel for each equipment item and system. Instruction shall be given by competent personnel.

   1. Duration: Total instruction period for all systems of this Division 23 shall be not less than fifteen (15) working days. The Owner reserves the right to audio-tape or video-tape the instruction procedure.

3.2 MANUFACTURERS' SERVICE REPRESENTATIVES

A. Verbal instruction at the site for the following equipment items and systems shall be given jointly by the contractor and the authorized manufacturer's service representative. (Contractor and manufacturer's service representative shall provide instruction to Owner for each equipment item of no less duration than the hours indicated in parenthesis. Duration shall be greater if otherwise specified).

   1. Air Handling Units. (48 hours)
   2. Terminal Units. (8 hours)

END OF SECTION 23 05 15

SECTION 23 05 16
HOUSEKEEPING PADS, CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide concrete housekeeping pads for the equipment listed in this section. This work shall be performed by the concrete installer.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Divisions 22 and 23 and to all other applicable portions of the drawings and specifications.

B. This section directly related in particular to sections (which may or may not be included in this division) which describe the following:

1. Concrete described in other divisions.

PART 2 - PRODUCTS

2.1 GENERAL

A. All concrete and steel for concrete housekeeping pads shall comply with those sections of the specification division describing concrete and steel.

2.2 HOUSEKEEPING PADS

A. Provide reinforced (#4's @ 12" both ways with 1-1/2" top cover) concrete housekeeping pads for each individual machine. Pads shall extend six inches beyond the machine bases in all directions and be continuous beneath the machine. Pads shall have chamfered edges and shall be poured and finished smooth and level to insure proper and continuous support for the bearing surfaces of the machine.

B. Coordinate exact length and width of each pad and any penetrations which may be necessary for piping or conduit with the actual equipment approved for use on the project.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to the section describing vibration isolation for equipment which is to rest on concrete housekeeping pads.

3.2 PAD HEIGHTS

A. Provide 6" high concrete pads for the following:

1. All equipment specified or shown to be on a concrete pad if no height is given.
2. Indoor air handling units.
3. Control air compressor assembly.
4. Compression tank assembly (if floor mounted).
5. Floor mounted pumps.
6. Heating hot water boilers.
7. Domestic water heaters.

END OF SECTION 23 05 16

SECTION 23 05 18
PIPING: CONDENSATE DRAIN

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide condensate drain piping from cooling coil drain pans.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Air handling equipment with cooling coils.
2. Insulation.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions".

PART 2 - PRODUCTS

2.1 PIPE

A. Type M hard drawn copper conforming to ASTM Spec. B88.

2.2 FITTINGS

A. Wrought copper, solder joint, pressure type conforming to ANSI B16.22.

2.3 SOLDER

A. Composition SB5 (95/5), Fed. Spec. QQ-S-571d and Class 3 (Sil Fos), Fed. Spec. AA-S-561d, ASTM B32.

PART 3 - EXECUTION

3.1 GENERAL

A. Piping shall be sloped uniformly toward drain, and provided with trap seal having a depth, in inches, equivalent to one and one-half (1-1/2) times the total static pressure of the respective fan system. Traps shall be assembled using elbows and tees with threaded brass plugs to permit cleaning of trap and drain line. Piping shall be installed in a neat manner and shall be not smaller than full size of the equipment drain connection or three-quarters inch (3/4") whichever is larger.

3.2 JOINTS AND CONNECTIONS

A. General: Joints and connections shall be made permanently air, gas, and water tight.

B. Solder Joints: Cut pipe square using cutting tool which does not crimp pipe. Remove all burrs using pipe reamer and taking care not to flare the pipe end. Thoroughly clean the outside of pipe and the interior of the fittings using a fine sand cloth. Apply noncorrosive paste flux to the cleaned surfaces immediately and apply solder and heat, in accordance with manufacturer's instructions, to complete joint.

C. Equipment Connections: Connections to copper drain nipples may be made with solder joints provided care is exercised not to damage equipment, its insulation or finish. Connections to equipment having steel nipples shall be made using screwed to solder adapters with teflon tape applied to male threads prior to assembly.

3.3 ROUTING

A. Unless otherwise indicated, route pipe discharge as follows:

1. Roof Mounted Equipment: To nearest roof drain.
2. Interior Equipment: To nearest floor drain.

3.4 INSULATION

A. Insulate if so specified in section describing insulation.

END OF SECTION 23 05 18

SECTION 23 05 19
GAUGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide pressure gauges, gauge valves, test plugs, snubbers and similar devices for indication of operating conditions of such points as are indicated on drawings and as specified herein.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the drawings and specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Thermometers.
2. HVAC piping systems.
3. All HVAC equipment through which fluid flows and at which fluid pressures may need to be determined.

1.4 SHOP DRAWINGS

A. Refer to Section entitles "General Mechanical Provisions". Provide schedule of ranges and proposed locations.

PART 2 - PRODUCTS

2.1 GAUGES

A. Four and one-half inch (4-1/2") diameter with cast aluminum black finish flangeless case and chrome ring. Bourdon tube: phosphor bronze, silver soldered to socket and tip. Socket: forged brass bottom outlet type. Movement: stainless steel rotary type with delrin sector and bushings and micrometer type pointer. Acceptable: H.O. Trerice Co. 500X or an equivalent.

B. Where Permanent Gauge is Installed: Brass, needle valve, round knurled handle, 1/4" male x 1/4" female NPT. Acceptable: H. O. Trerice Co. 735 Type FFG, or equivalent.

C. Where Permanent Gauge is Not Installed: Brass gate valve 1/4" female NPT. Acceptable: Crane No. 438 or NIBCO No. T-113, or equivalent.

2.2 PRESSURE SNUBBER

A. Brass, 1/4" male x 1/4" female NPT. Acceptable: H. O. Trerice Co. 872-2, or equivalent.

2.3 COILED SYPHON PIGTAILS

A. Single turn 360 degree coil, arranged with plane of coil parallel to its flow, constructed of 1/4" tubing with male NPT threads on both end extensions. Acceptable: H. O. Trerice Co. 885-series.

2.4 TEMPERATURE/PRESSURE TEST PLUGS

A. Use at Contractor's option as specified in Part 3 of this section. Body of brass or 316 stainless steel. Valve core of neoprene for applications to 200°F and of Nordel for applications to 275°F. Rated for pressure to 1000 psig. Screwed hexagonal cap and gasket. Size 1/4" NPT or 1/2" NPT as applicable. Length 1-1/2" or 3" as applicable to penetrate and allow for insulation. Designed for taking temperature and pressure readings when used with recommended probes. Acceptable: Pete's Plug, Standard or XL Size as manufactured by Peterson Equipment Company, Inc., Richardson TX 75081; Sisco P/T Plugs; or equivalent.

1. Test Kit: Provide Owner with one companion test kit suitable for taking temperature and pressure readings with test plugs. Provide to Architect/Engineer written certification of delivery of test kit to Owner; certification shall be signed by Owner's authorized representative.

PART 3 - EXECUTION

3.1 GENERAL

A. Install pressure gauges, gauge valves, test plugs and snubbers in accordance with manufacturer's instructions and locate in such a manner as to permit easy reading of all gauges associated with a single piece of equipment from a single point on the floor (or working platform).

3.2 PRESSURE GAUGES

A. Install in such a manner as to give an accurate reading of the actual conditions and to permit easy access to gauge and gauge valve. Where mounting location does not permit rotation of the gauge for removal, install using the union type (880) gauge valve. Range shall be selected to read near center at normal operating conditions.

3.3 GAUGE VALVE

A. Install using brass nipples of sufficient length to raise gauge valve clear of insulation and finish.

3.4 SNUBBER

A. Provide on all gauges at suction and discharge of all pumps and elsewhere as required to prevent pulsation.

3.5 COILED SYPHON PIGTAIL

A. Provide on pressure gauges used to steam service. Install pigtails and gauges vertically.

3.6 LOCATIONS NOT SHOWN ON DRAWINGS

A. Provide as described in this section unless individual locations are otherwise shown on drawings.

3.7 PERMANENT PRESSURE GAUGE LOCATIONS

A. Provide permanent gauges, with gauge valves, at the following locations:

1. Fluid inlet and outlet of:

    a. Each water coil in each air handling unit.
    b. Hydronic system strainers in main piping system (not required at strainers which may be located at individual air handling units or similar equipment unless otherwise indicated).
    c. Each air separator.
    d. Each water inlet and outlet at each chiller.

2. Suction and discharge of each pump.
3. Where otherwise indicated.

3.8 GAUGE VALVE ONLY LOCATIONS

A. Provide gauge valves to permit temporary or permanent installation of gauges for pressure indication at the following locations:

1. Inlets and outlets of water coils at:

    a. Each fan coil unit.
    b. Each terminal unit hot water coil.
    c. Where otherwise indicated.

3.9 TEMPERATURE/PRESSURE TEST PLUGS

A. Where a gauge valve and a thermometer well is indicated as a pair (i.e., side by side), Contractor may at his option, provide only a single test plug. Provide only at the following location (at Contractor's operation in lieu of the gauge valves specified above and in lieu of thermometer wells specified in "Thermometers" section):

1. Inlets and outlets of each coil at each terminal unit.
2. Inlet and outlet of each coil in each fan coil unit.

3.10 PROTECTION OF EQUIPMENT

A. Protect equipment from damage from time of its receipt until final acceptance and shall thoroughly clean the pressure gauges, gauge valves and like items of all dirt and construction debris prior to requesting final inspection. Gauges which become damaged during the course of construction shall be repaired to "as new" condition or shall be replaced with new equipment.

END OF SECTION 23 05 19

SECTION 23 05 20
PIPING SYSTEMS: FLUSHING AND CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Completely flush and clean the new piping systems for chilled water prior to making final connections to the existing central system. Provide all plant, materials, equipment and labor required to flush and clean the new piping systems prior to operation.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

A. Include specific data on: all chemicals, feeders, blow down valves and like items; as well as complete piping diagrams. Include complete description of methods.

1.5 PRESSURE AND TEMPERATURE RATINGS

A. Unless otherwise specified in this section, components specified by this section shall be recommended and rated for same (or greater) maximum working pressure and temperature conditions which are applicable to the fluid system at the location(s) at which the equipment and systems of this section are installed. Refer to specification section(s) describing the related fluid systems(s) for pressure and temperature ratings applicable to the components of this section.

1.6 MANUFACTURER'S QUALIFICATIONS

A. The water treatment chemical supplier shall be a recognized specialist, active in the field of industrial water treatment for at least ten years.

PART 2 - PRODUCTS

2.1 SHOT FEEDER

A. Provide a temporary shot feeder installed across the pumping system suction and discharge sides to allow injection of cleaning chemicals into the system.

B. Shot feeders shall be Mogul, Mitco, Garrett Callahan, Culligan, Nalco or equivalent.

2.2 WATER TREATMENT CHEMICALS

A. Formulation shall not contain any ingredients which are harmful to system materials.

B. Chemicals shall be supplied same manufacturer that is currently supplying chemicals to the owner.

PART 3 - EXECUTION

3.1 GENERAL

A. Install chemical feeding systems as indicated, in accordance with manufacturer's installation instructions, to comply with requirements and intended purposes.

3.2 SHOT FEEDER

A. Install shot feeder with adequate pressure differential to permit flow through the chemical feeder body. Connect feed piping to inlet and outlet connections with shutoff valves. Pipe drain valve discharge to drain.

B. Provide all hardware and chemicals for start-up of system and full operation of initial system fill.

C. Connect water treatment piping system to mechanical systems and comply with equipment manufacturer's instructions where not otherwise indicated. Install shutoff valve and union or flanges on supply and return, drain valve on drain connection.

3.3 CLEANING AND FLUSHING

A. All piping lines and related equipment shall be thoroughly flushed out with precleaning chemicals designed to remove deposition such as pipe dope, oils, loose rust and mill scale and other extraneous materials. Add recommended dosages of precleaner chemical products and circulate throughout the water system. Feed chemicals at the proper feed rates, check that the cleaning solution is actually in each system, flush the system and shall check each system following flushing to insure all cleaning chemicals have been removed from each system. Open all modulating valves, zone valves and all other system restrictions. Drain, fill and flush system until no foreign matter is observed.

B. Chemical used for cleaning of systems shall comply with the recommendations of the manufacturers of the major components in the system.

C. A certificate of cleaning shall be provided by the cleaning chemical supplier to the Owner.

3.4 PIPING

A. Installation of piping shall be made in a manner which provides for all drains and temporary connections necessary to clean and flush the new piping systems.

3.5 OTHER REQUIREMENTS

A. Provide all necessary pipe, valves, fittings, unions and other items necessary for proper installation and removal of all components needed to clean and flush the system.

B. Locate temporary shot type feeder in valved bypass from pump discharge to pump suction. Provide gate valve in bypass on each side of feeder.

END OF SECTION 23 05 20

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SECTION 23 05 21
THERMOMETERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide thermometers and wells for temperature indication at such points as indicated on drawings and as specified herein.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the drawings and specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Gauges.
2. HVAC piping systems.
3. All HVAC equipment which contains heat transfer components where fluid temperatures may need to be determined.

1.4 SHOP DRAWINGS

A. Refer to section entitled "General Mechanical Provisions". Provide schedule of ranges and proposed locations.

PART 2 - PRODUCTS

2.1 THERMOMETERS

A. Adjustable angle, nine inch (9") long scale, mercury type with range selected to read center scale at normal operating conditions; extension necks and bulb style selected to suit application; armored elements on duct thermometers. Acceptable: H.O. Trerice Co BX93403-1/2 and BS99006 or equivalent.

2.2 SEPARABLE SOCKETS

A. Provide for each thermometer in piping system. Sockets: Brass with extension neck to suit thickness of insulation and finish 3/4" NPT.

2.3 THERMOMETER TEST WELLS

A. Brass with extension neck to suit insulation cap with chain; 1/2" NPT; extension neck where necessary to penetrate insulation.

2.4 TEMPERATURE/PRESSURE TEST PLUGS

A. Use at Contractor's option as specified in Part 3 of this section. Body of brass or 316 stainless steel. Valve core of neoprene for applications to 200°F and of Nordel for applications to 275°F. Rated for pressure to 1000 psig. Screwed hexagonal cap and gasket. Size 1/4" NPT or 1/2" NPT as applicable. Length 1-1/2" or 3" as applicable to penetrate and allow for insulation. Designed for taking temperature and pressure readings when used with recommended probes. Acceptable: Pete's Plug, Standard or XL Size as manufactured by Peterson Equipment Company, Inc., Richardson, TX 75081; Sisco P/T plugs; or equivalent.

1. Test Kit: Provide Owner with one companion test kit suitable for taking temperature and pressure readings with test plugs. Provide to Architect/Engineer written certification of delivery of test kit to Owner; certification shall be signed by Owner's authorized representative. Duplicate test kit is not required under this section if provided under section describing gauges.

PART 3 - EXECUTION

3.1 GENERAL

A. Install test wells, separable sockets, and thermometers in accordance with manufacturer's instructions. Locate in such a manner (adjusting mounting angle as required) as to permit easy reading of all thermometers associated with a single heat transfer device from a single point on the floor (or working platform).

3.2 THERMOMETERS IN PIPING SYSTEMS

A. Install in such a manner as to give accurate reading of actual conditions. Make allowance for proper (unrestricted) flow by installing in oversized fitting in line sizes two inches (2") and under.

3.3 THERMOMETERS IN DUCT SYSTEMS

A. Install in such a manner as to give accurate reading of actual conditions.

3.4 PROTECTION OF EQUIPMENT

A. Protect equipment from damage from time of receipt until final acceptance. Thoroughly clean thermometers, wells and like items of all dirt and construction debris prior to requesting final inspection. Thermometers which become damaged during course of construction shall be repaired to "as new" condition or shall be replaced with new equipment.

3.5 LOCATIONS NOT SHOWN ON DRAWINGS

A. Provide as described at locations in this section unless individual locations are otherwise specifically shown on drawings.

3.6 THERMOMETER LOCATIONS

A. Provide permanent thermometers and companion wells at the following locations:

1. Fluid inlet and outlet of:

a. Each water coil in each air handling unit.
b. Each water inlet and outlet of each chiller.

2. Where elsewhere specified or indicated on the drawings.

3.7 THERMOMETER TEST WELL LOCATIONS

A. Provide thermometer test wells at:

1. Inlets and outlets of each water coil at each unit which is not a packaged air handling unit or a built-up air handling unit (i.e., terminal unit hot water coils, fan coil unit coils, duct mounted hot water coils and similar units).
2. Where elsewhere specified or indicated on the drawings.

3.8 TEMPERATURE/PRESSURE TEST PLUGS

A. Where a thermometer well and a gauge cock is indicated together as a pair (i.e. side by side), Contractor may, at his option, provide only a single test plug is required. Provide only at the following locations (at Contractor's option in lieu of the test wells specified above and in lieu of the gauge cocks specified in "Gauges" section).

1. Inlets and outlets of each water coil at each unit which is not a packaged air handling unit or a built-up air handling unit (i.e. terminal unit hot water coils, fan coil unit coils, duct mounted hot water coils and similar units.)
2. Where elsewhere specified or indicated on the drawings.

3.9 ADDITIONAL INSTALLATION REQUIREMENTS

A. Install near pressure gauge cocks and flow meter ports where practical but not to deflect flow and cause raise readings of such other instruments.

B. Install to cause least possible condensation.

C. Thermometers shall be easily readable by person in normal position; adjust mounting configuration accordingly.

D. Provide pipe extensions where installation is in pipe with diameter smaller than insertion length or install in oversized pipe sections.

E. Install thermometers and test wells as follows so that wells will hold gauge oil without spilling when wells are being used for testing and balancing:

1. In horizontal pipe so that the well is in the top quadrant of the pipe and is not less than 45° from vertical.
2. In vertical pipe so that the well is 45° from vertical.

END OF SECTION 23 05 21

SECTION 23 05 22
FLOW STATIONS, VENTURI TYPE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide venturi type flow stations, where specified and where indicated on piping plans and schematics, to enable the proper flow balancing of systems.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions" for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the drawings and specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. HVAC piping systems.
2. Performance verification.
3. Insulation.

1.4 PRESSURE RATING

A. Be recommended and rated for the pressure conditions occurring at each individual venturi installation location for the particular fluid flow system in which the venturi is installed.

1.5 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Include complete data on: dimensions; working pressure; body pattern; installation instructions including upstream and downstream clearances; indicating and permanent pressure losses; tagging; accessories; and materials and finish.

1.6 MANUFACTURERS

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Gerand
2. Barco
3. Flowset
4. Olympic
5. Preso

PART 2 - PRODUCTS

2.1 FLOW STATIONS

A. Venturi type, selected to provide an indicating differential pressure, at the design flow rate, between ten (10) and forty (40) inches of water. Permanent pressure loss shall not exceed twenty-five (25) percent of indicated flow rate differential pressure. Stations up to and through two inch (2") in size shall be brass with screw end connections. Stations two and one-half inch (2-1/2") and above shall be steel with butt weld ends.

2.2 FLOW STATION ACCESSORIES

A. Each flow station shall be provided with the following accessories:

1. Quick Disconnect Valves: Provide quick disconnect valves, compatible with the master meter, for each meter tap of each flow station.
2. Safety Shut-Off Valves: Provide a safety shut-off valve between each quick disconnect valve and its respective meter tap. Shut-off valves shall be mounted on the flow station with brass pipe nipples of sufficient length to bring the valve clear of specified insulation and finish.

B. Tag: Provide a metal (or paper bonded between two (2) sheets of plastic) identification tag attached to each flow station with a brass chain of sufficient length to allow tag to clear the specified insulation and finish. Tag shall clearly show: Venturi series and size, station identification, and meter reading at flow required by approved piece of equipment.

C. Master Meter: Six inch (6") round dial, dry type meter supplied with white on black scale reading from zero (0) to fifty (50) inches of water differential pressure. Meter shall be mounted in a portable fiberglass (rot proof) carrying case complete with two (2) ten foot (10') lengths of one-quarter inch (1/4") high pressure high temperature connecting hose with quick disconnect socket valves, vent valves, vent hoses, operating instructions, and flow station capacity curves.

PART 3 - EXECUTION

3.1 LOCATION

A. Provide venturi type flow stations where shown on drawings. The flow station locations shown on drawings or otherwise indicated are diagrammatic in nature and are intended basically to show the requirement for flow measurement relative to a specific piece of equipment or portion of the system and not the exact physical location of the device. The exact physical location shall be determined using field measurements relating to the specific piping arrangement and the manufacturer's requirements relating to upstream and downstream clearances.

3.2 PIPING

A. The actual installation or incorporation of flow stations into the piping system shall be done as work of the Section covering the piping system involved.

B. Install flow stations in accord with manufacturer's recommendations including increases or decreases in pipe size at point of installation together with minimum recommended lengths of straight run pipe before and after points of installation.

3.3 BALANCING

A. Shall be done, using the master meter specified hereinbefore, as work of the section describing test and balance. At the conclusion of the test and balance work the meter shall be turned over to, and shall become the property of, the Owner. Include a receipt for delivery of the meter, complete as specified herein, in good condition as a part of the Operating and Instruction manuals.

END OF SECTION 23 05 22

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SECTION 23 05 23
VALVES, COCKS AND SPECIALTIES: HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide those valves, cocks and specialties which are required for the HVAC piping systems. These items include, but are not necessarily limited to, the following:

1. Gate valves.
2. Check valves.
3. Ball valves.
4. Cocks and plug valves.
5. Drain valves.
6. Butterfly valves.
7. Backflow preventers.
8. Strainers.
9. Safety valves.
10. Pressure relief valves.
11. Air vents.
12. Flow indicating/balancing valves.
13. Pump suction guide/strainer/elbows.
14. Pump discharge/flow control valves.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of the Division-23 and to all other applicable portions of the drawings and specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Piping systems.
2. Pumps.
3. Insulation.
4. Equipment connected to piping systems in which work of this section is applicable.
5. Air control equipment.
6. Work which is described in Divisions 22 and 23 which relate to the plumbing systems and which requires valves, cocks and specialties shall be provided in compliance with this Section unless requirements of Divisions 22 and 23 specifically state otherwise.

1.4 APPLICABLE SYSTEMS

A. These valves, cocks and specialties are intended for application in, but not necessarily limited to, the following HVAC piping systems as applicable to this project.

1. Chilled water systems.
2. Condenser water systems.
3. Other related HVAC piping systems.

1.5 VALVES, COCKS AND SPECIALTIES

A. Valves, cocks and specialties may not be indicated in every instance on the drawings, but whether or not shown, all valves, cocks and check valves necessary to the proper operation of the system shall be furnished and installed in an approved manner and location. Valves shall have rising stems except in locations where space is limited; in these locations non-rising stem valves of equivalent material and pressure class will be accepted.

1.6 ACCEPTABLE MANUFACTURERS

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Mueller
2. Hammond
3. Crane
4. Powell
5. Walworth
6. Lunkenheimer
7. Stockham
8. Williams-Hager
9. APCO
10. Metraflex
11. ACFR
12. Keystone
13. Centerline
14. Demco
15. Gerand
16. Griswold
17. Aeroquip
18. Dezurick
19. Watts
20. Maxwell & Moore
21. Bell & Gossett
22. Beaton-Cadwell
23. McDonnell Miller
24. Maid-O-Mist
25. Sarco
26. Nibco
27. Jamesbury
28. Taco
29. Wheatley Pump & Valve

30. Conbraco
31. Grinnell
32. McDonald
33. Flow Design
34. Weksler

B. Any model numbers listed are from one or more of these manufacturers and are given to provide an example of the item(s) required.

1.7 INDUSTRY STANDARDS

A. Where compliance with an industry, society or association standard is specified or indicated, certification of such compliance shall be submitted with shop drawings.

1.8 PRESSURE AND TEMPERATURE RATINGS

A. Temperature: Unless otherwise specified, ratings shall be as follows for all components specified herein.

1. Chilled water systems: 150°F
2. Condenser water systems: 150°F

B. Pressure: Unless otherwise specified, all components must be of pressure class and rating to be recommended for operation at the following maximum allowable non-shock pressure ratings.

1. Chilled water systems: 150 psig
2. Condenser water systems: 150 psig

PART 2 - PRODUCTS

2.1 GATE VALVES

A. 3" and smaller: Threaded or solder pattern as applicable, rising stem, iron wheel, rough brass body, solid wedge disc, screwed or union bonnet and finished gland nut, 150 psi class. Types as follows:

1. Threaded Pattern: Crane 431, Powell 514S, Walworth 56, Lunkenheimer 2151, Stockham B-122.
2. Soldered Pattern: Powell 1842S, Lunkenheimer 2151, Stockham B-124.

B. 3-1/2" and Larger: Flanged, cast iron body, brass trim, brass seats, rising stem and iron wheel, 125 psi class. Types as follows: Crane 465-1/2, Powell 1793, Walworth 726F, Lunkenheimer 1430, Stockham G-623.

2.2 GLOBE VALVES

A. 2-1/2" and Larger: Flanged, iron body, yoke bonnet, bronze trim and disc.

B. 2" and Smaller: Screwed, bronze body, union bonnet composition disc.

2.3 CHECK VALVES

A. Swing type:

1. 3-inches and Smaller: Threaded or solder pattern as applicable, pressure rating of not less than 200 psi threaded pattern and 125 psi solder pattern, wye pattern swing check, rough brass body, finished gland nut, regrinding bronze disc.
2. 4-inches and Larger (125 psi maximum working pressure): Flanged pattern, iron body, swing check, renewable brass seat, disc and trim. Types: Crane 373, Powell 559, Walworth M-928F, Lunkenheimer 1790, Stockham G-931.
3. 4-inch and Larger (200 psi maximum working pressure): Flanged brass-ferrosteel body, swing check, renewable brass seat, disc and trim. Types: Crane 39E, Powell 576, Walworth M-970F, Lunkenheimer 323.

B. Wafer Type:

1. 3-inch and Larger: Flanged pattern, globe type, semi-steel body, stainless steel spring, bronze disc and bronze seat ring. Types: Williams-Hager Figure 636; APCO Series 600; Mueller Nos. 105, 107, 109 and 113; Metraflex Series 900.

2.4 PLUG VALVES AND BALANCING COCKS

A. General: Semi-steel, lubricated type, bolted cover or gland, position indication dial, full port, teflon coated plug. Over 6-inches shall have a geared or worm drive operator.

B. 2 inches and Smaller: Screw pattern Powell F-2200, Walworth 1700, ACF R1430.

C. 2-1/2 inches and Larger: Flanged end. Powell F2201, Walworth 1700F, ACF R 1431.

2.5 DRAIN VALVES

A. General: Use only for low pressure drainage service.

B. 2 inches and Smaller: Either threaded or soldered ends, class 125, bronze body, screwed bonnet, rising stem, disc with 3/4" hose thread outlet connect.

1. Threaded Pattern: Crane 410, Stockham B-100.
2. Soldered Pattern: Crane 1320, Stockham B108.

2.6 BUTTERFLY VALVES

A. Pattern: Valves shall be of the threaded lug body type. All valves shall have extended necks for insulation clearance.

B. Body: Semi-steel or cast iron or pattern specified hereinbefore.

C. Disc: Bronze or semi-steel with welded nickel edge, 416 stainless steel shaft, bronze bearings, and Hycar seals.

D. Seat: Hycar, bonded to a rigid reinforcing ring which is held in place by a metal retaining ring. All valves shall be capable of bubble tight shut-off at pressure differentials of 200 psig, and 200 psig dead end shut-off.

E. Operators: Valves 2" through 6" shall have lever type actuator capable of infinite position (or minimum of 10 locking positions) and shall have adjustable memory stop. Valves 8" and larger shall have gear type actuator with chain wheel, hand wheel or crank type operating mechanisms, adjustable opening and closing memory stops, and position indicator. All valves 4" and larger located more than 6'-0" above the floor shall be provided with chain wheel and chain. Provide stem extensions (in addition to insulation clearance extension specified hereinbefore) as required to place operators in an easily accessible location free of interference with adjacent piping, equipment structure, and the like.

F. Manufacturers: Grinnell, Keystone, Center-Line, Demco, DeZurick.

2.7 BALL VALVES

A. 2-1/2 inches and Smaller: Threaded or soldered ends, port area equal to or greater than connecting pipe diameter, Class 125, two piece bronze body, bronze ball, bronze stem, teflon seat and seals. Acceptable manufacturers; Crane, Hammond, Jamesbury, Nibco, Stockham, and Walworth.

2.8 CALIBRATED BALANCING AND FLOW MEASURING VALVES

A. 1/2" to 2": Globe type providing flow balancing, flow measurement, positive shut off, and drain connection. Balancing valves shall be provided with vernier-type setting with adjustment range through four 360 degree turns of handwheel. Valves shall have hidden memory feature to prevent tampering. Valves shall be provided with meter connections having positive shut off valves. All metal parts shall be of nonferrous, pressure die-cast, nonporous Ametal Copper Alloy. Valve shall provide accurate flow control regardless of valve orientation. Provide form-fitting polyurethane insulation cover. Design basis Armstrong CBV I. Acceptable Alternates: Accepted equivalents by Bell & Gossett, Taco, and Preso.

B. 2-1/2" to 6": Globe type providing flow balancing, flow measurement, and positive shut off. Balancing valves shall be provided with vernier-type setting with adjustment range through eight 360 degree turns of handwheel. Valves shall have hidden memory feature to prevent tampering. Valves shall be provided with meter connections having positive shut off valves. Valves shall be cast iron with brass trim. Design basis Armstrong CBV II. Acceptable Alternates: Accepted equivalents by Bell & Gossett, Taco and Preso.

C. Provide Owner: One portable differential pressure gauge kit of same manufacturer as valves. Kit shall be housed in a hand-carrying case and shall contain one 0-135" W.C. and one 0-60 foot pressure gauge, 5 foot meter hoses with disconnect ends, positive shutoff valves, operating instructions, and flow versus pressure drop curves for each size valve installed.

2.9 FLOW CONTROL VALVES, PRESSURE COMPENSATING, ACCESSIBLE

A. Automatic pressure compensating flow control valves which operate as mechanically independent devices on a mechanically based variable orifice principal. Provide where specified and where indicated on piping plans and schematics, to enable the proper flow balancing of systems. Acceptable manufacturers: Griswold, Taco.

B. Valves shall be factory set and shall automatically limit the rate of flow to required engineered capacity within 5% accuracy over an operating pressure differential of at least 14 times the minimum required for control.

C. Control mechanism of valve shall be a self-contained, open-chamber cartridge assembly with unobstructed flow passages to eliminate accumulation of particles and debris. All internal working parts shall be type 300 passivated stainless steel. No plated materials are acceptable.

D. Control valve mechanism shall be accessible for changeout if needed without disconnecting the piping system in which it is installed.

E. Valves shall be available in four pressure differential ranges, with the minimum range requiring less than 2 psi to control flow. Cast iron valve bodies shall be provided with inlet and outlet tappings suitable for connection of instruments for verification of flow rates. Valve bodies shall be rated for use at not less than 150% of system designed operating pressures.

F. Each automatic flow control valve shall be furnished with a valve kit consisting of 1/4 inch x 2 inch minimum size nipples, quick-disconnect valves (to be located outside of insulation), and fittings suitable for use with companion measuring instruments.

2.10 STRAINERS

A. General: Y-type.

B. Body: Cast iron, ductile iron, cast or forged steel as required for specified working pressure of piping system.

C. Screen: 315 stainless steel or monel. Free area not less than three times inlet area.

1. Perforations: 1/8" mesh for sizes to 8-inches. 5/32" mesh for sizes 10-inches and larger.

D. Connections:

1. Straight thread and gasket to 2-inch size.
2. Flanged 2-1/2 inches and larger.
3. Solder pattern when used in copper piping systems.

E. Bolted cover in 2-1/2 inch and larger.

F. Gate Valve: On 2-1/2 inch size and larger, provide a gate valve on each strainer cover blowdown connection; gate valve to be full size of blowdown connections.

2.11 SAFETY VALVES

A. General: ASME rated as shown on the drawings and/or required by applicable codes.

B. Manufacturers: Manning, Maxwell & Moore, Watts Regulator, or Bell & Gossett Co.

2.12 PRESSURE RELIEF VALVES

A. One-half (1/2) or three quarter (3/4) inch size, brass, iron or steel, ASME rated.

2.13 AIR VENTS

A. Automatic:

1. 150 psi Working Pressure: Metraflex MV-15, Crane 976, Sarco 13W, Armstrong 1AV.
2. 75 psi Working Pressure: Maid-O-Mist #7, Bell & Gossett #7, Hoffman 79.

B. Manual: Brass manual cock, Crane 700 Series, with hose thread adapter.

2.14 PUMP SUCTION GUIDE/STRAINER ELBOW

A. Sizes Allowable: 2" through 12".

B. Construction: At the Contractor's option, in lieu of strainer and long sweep elbow, provide at each pump a suction guide/strainer elbow. Units shall consist of cast iron angle type body (175 psi pressure rated) with cast iron inlet vanes and a combination stainless steel diffuser strainer with 3/16" or 1/3" diameter openings for pump protection. (Unit shall be equipped with a disposable brass or bronze fine mesh start up strainer which shall be removable after 30 days). The body outlet pipe size shall be equal to the pump suction pipe size. The unit shall be provided with an adjustable support foot to relieve piping strains from the pump suction, threaded pressure gage tap at the body inlet and blowdown tapping in bottom.

C. Acceptable Manufacturers: Armstrong Pumps, Inc., Taco, Inc.; Bell & Gossett or equivalent.

2.15 PUMP DISCHARGE/FLOW CONTROL VALVES

A. Allowable Sizes: 1-1/2" through 10".

B. Construction: At Contractor's option, install pump discharge valves on each pump discharge line in lieu of separate shutoff valve, check valve, and balance cock. Pump discharge flow control shall be cast-iron valve body, pressure rated for 175 psi, maximum operating temperature of 300^{o}F. Provide check valve and calibrated adjustment feature permitting regulation of pump discharge flow and shutoff. Bronze gland, stainless steel stem, brass or bronze seat, graphited asbestos packing or double "O" ring seal straight or angle pattern. Angle pattern valves shall be provided with adjustable support foot.

C. Acceptable Manufacturers: Armstrong Pumps, Inc., Bell & Gossett; Taco, Inc.; or equivalent.

PART 3 - EXECUTION

3.1 GENERAL

A. Install valves in horizontal piping with the valve stem in the vertical upright position.

B. Install valves to provide adequate clearance to permit easy operation of the valve hand wheel and permit servicing of the valve packing.

C. Provide blow down valve on 1-1/2" and larger strainers (except refrigerant piping). Use valve not less than 1/2 strainer blow down outlet size.

3.2 VALVES AND COCKS

A. All valves, balancing cocks and similar items shall be installed in an easily accessible location. Provide access panels for all concealed valves. Where gate valves are indicated on the drawings, the Contractor may, at his option, furnish butterfly valves, provided they are in compliance with these specifications. Where butterfly valves are used, they shall be installed between properly spaced flanges, then run to the full open position before mounting bolts are tightened in order to insure a balanced pressure on the seat and prevent distortion.

3.3 PRESSURE RELIEF VALVES

A. Install pressure relief valves where specified or indicated on the drawings. Pipe to spill over floor drain or service sink. Provide pressure expansion device for all valves set for 150-psig or greater.

3.4 PUMP DISCHARGE FLOW CONTROL VALVES

A. Where such valves are used, install pump discharge/flow control valves on each pump discharge. Install in horizontal or vertical position with stem in upward position; allow clearance above stem for check valve mechanism removal. After hydronic system has been completed, mark calibrated name plate with stripe of yellow lacquer to permanently mark final balanced position.

B. Install adjustable foot support for angle pattern valves to carry weight of discharge piping.

3.5 SAFETY VALVES

A. Safety valves to have valve spindle enclosure with gland seal to minimize leakage and manual lift lever to check discharge required. Cut discharge pipe from safety valve on a 45 degree angle, pipe to floor and direct toward or into floor drain (unless noted otherwise on the drawings).

3.6 AUTOMATIC AIR VENTS

A. Install automatic air vents with inlet isolation cock at locations indicated on drawings and at high points of hot and chilled water piping systems. Pipe vent discharge to drain pan, plumbing trap or to outside of building.

3.7 DRAIN VALVES

A. Install drain valves at the base of all water piping risers (both supply and return) and at all low points in the piping system.

3.8 BALL VALVES

A. Ball valves may be installed in lieu of gate valves for all individual fan coil unit supply and return piping 1" and smaller.

3.9 VALVED GAUGE CONNECTIONS

A. Contractor shall provide valved gauge connections at diffuser inlet and pump suction to indicate when cleaning is needed. Install on pump suction inlets, adjust foot support to carry weight of suction piping. Install nipple and shutoff valve in blowdown connection. After cleaning and flushing hydronic piping system, but prior to balancing of hydronic piping system, remove disposable fine mesh strainer.

3.10 CALIBRATED BALANCING AND FLOW MEASURING VALVES

A. Provide flow indicating balancing valves where shown on drawings. The locations shown on drawings or otherwise indicated are diagrammatic in nature and are intended basically to show the requirement for flow measurement and shut-off relative to a specific piece of equipment or portion of the system and not the exact physical location of the device. The exact physical location shall be determined using field measurements relating to the specific piping arrangement and the manufacturer's recommendations relating to upstream and downstream clearances. Install in accordance with manufacturer's recommendations including increases or decreases in pipe size at points of installation together with minimum recommended lengths of straight run pipe before and after points of installation. Balancing shall be done, using the master meter specified hereinbefore, as work of the section describing test and balance. At the conclusion of the test and balance work the meter shall be turned over to, and shall become the property of, the Owner.

3.11 MECHANICAL ACTUATORS

A. Install mechanical actuators with chain operators where indicated, and where valves 4" and larger are mounted more than 7'-0" above floor in mechanical rooms, chiller rooms, boiler rooms; and where recommended by valve manufacturer because of valve size, pressure differential or other operating condition making manual operation difficult.

END OF SECTION 23 05 23

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SECTION 23 05 24
AIR CONTROL EQUIPMENT, HYDRONIC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide a complete system of makeup water and/or air control equipment for each separate chilled water and/or hot water system as indicated on drawings and as specified herein.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the drawings and specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. HVAC water piping systems.
2. Valves, cocks and specialties for HVAC systems.

1.4 TERMINOLOGY

A. Compression tanks and expansion tanks shall be considered the same regardless of terminology.

PART 2 - PRODUCTS

2.1 GENERAL

A. Equipment shall be sized as indicated on drawings.

2.2 EXPANSION TANK(S)

A. Tank: Steel, ASME approved, 125 psig working pressure.

B. Trim: Gauge glass, gauge cocks and all necessary tappings including union connected gauge valves, stainless steel trim, acrylic gauge tube, drain cock, built-in check valves. Acceptable: Penberthy Series 205; Eugene Ernst Products Model EEP 203 or equivalent.

C. Tank Fitting: Designed to control air flow into tank while preventing free interchange of water between tank and system; manual air vent tube; 125 psig; Bell & Gossett ATF or ATFL Series or equivalent.

D. Manufacturer: Taco, Armstrong, Bell & Gossett, John Wood Company or equivalent.

2.3 AIR SEPARATION DEVICE(S) GENERAL

A. General:

1. ASME approved and stamped.
2. 125-psig working pressure.
3. Cast iron or steel.

B. Recommended by manufacturer to be suitable for operation with flow rate indicated with pressure drops not in excess of that indicated.

C. Tangential type which operates on low velocity vortex principle of separation of free air from system.

D. Strainer, built-in accessible type.

E. Dimensions suitable for available space.

F. Separators with inlet and outlet connections four inches (4") and larger shall be provided with threaded couplings factory welded to shell for pipe support lets.

G. Design Basis: Bell & Gossett "Rolairtrol", Armstrong, Taco or equivalent.

2.4 AIR VENTS

A. Automatic Air Vents: Male pipe thread connection (3/4 inch minimum); brass body; brass or stainless steel float; check valve feature to prevent air re-entry; drain connection; 300^{o}F operating temperature.

1. 150-psig operating pressure: Suitable for 450-psig hydrostatic pressure. Hoffman No.78, Metraflex MV-15, Crane #976, Sarco 13W or Armstrong 1AV or equivalent.
2. 75-psig working pressure: Suitable for 200-psig hydrostatic pressure. Hoffman No.79, Maid-O-Mist #7, Bell & Gossett #7 or equivalent.

B. Manual Air Vents: Brass, suitable for 500 psig operating pressure and 300^{o}F operating temperature, needle valve type, 1/8 inch size minimum, Trerice No. 735, Crane 700 Series or equivalent.

C. Drain Tubing: Type M copper.

2.5 MAKEUP WATER ASSEMBLY(S)

A. Provide for each closed loop chilled water and hot water system. Use the following components or their equivalent:

B. Reducing Valve(s): Brass body, 3/4-inch or greater F.I.P.T. connections, brass trim, built-in strainer, anti-siphon check valve, extra large diaphragm, adjustable twenty-five (25) to sixty (60) psig. Acceptable: Bell & Gossett #7 or an accepted equivalent.

C. Relief Valve: Brass body, 3/4-inch or greater M. x F.I.P.T. connections, brass trim, diaphragm operated, seventy-five (75) psig setting.

PART 3 - EXECUTION

3.1 GENERAL

A. Install all air separators, compression tanks and similar items in strict accordance with the manufacturer's instructions.

B. Test piping systems prior to the application of any insulation and prior to their being rendered inaccessible by the progress of the work. Pressure test the makeup water piping as specified for the potable water piping system.

C. Pipe, valves and fittings shall be kept clean and protected from entrance of dirt, non-potable water and construction debris during the installation process.

D. Refer to sections covering closed loop hydronic systems. Coordinate work of other trades as regards their interface on makeup water piping.

E. Connect water make-up line to pipe which connects air separation device to compression tank assembly. Pipe size from make-up water connection to air separation device shall be same size as make-up water line.

3.2 EXPANSION TANK ASSEMBLY(S)

A. Drain: Provide valved 3/4 inch minimum diameter tank drain to a point six inches or less above nearest mechanical room floor drain.

B. Support: Securely support from roof or floor structure and/or from masonry wall(s). Submit shop drawings showing method of support if such drawings are required by Architect/Engineer.

C. Insulation: Insulate if and as specified elsewhere.

3.3 AIR SEPARATION DEVICE

A. Remove and clean strainer after 24 hours and 30 days of system operation.

B. Isolate air separator with gate valves.

C. Install so strainer is accessible.

D. Provide valved blowdown drain.

E. Insulate; insulation finish shall match finish of connecting piping insulation.

3.4 AIR VENTS

A. Use automatic vents in concealed spaces. Provide tubing discharge to drain pan, plumbing trap, exterior of building or other approved location. Discharge at inconspicuous and safe location. Install automatic air vents with inlet isolation cock.

B. Provide manual vents at each heating and cooling water coil in accordance with coil manufacturer's recommendations.

C. Provide automatic vents as follows:

1. High points of all main hot water and chilled water piping.
2. In all hot water and chilled water pipe sections which form an inverted trap.
3. Where necessary to completely and properly vent all air which may accumulate in piping circuits.
4. Where otherwise indicated.

D. Provide automatic air vents with gate valve or ball valve in pipe nipple to air vent so that air vent can be removed without affecting pipe system operation.

3.5 MAKEUP WATER ASSEMBLY(S)

A. Provide as follows if not indicated in Divisions 22 and 23 which describe plumbing interface or if not shown on drawings:

1. 1-1/4-Inch (Less if Indicated) Make-up Assembly:

a. Automatic feed line with the following in series in direction of flow: Gate valve, pressure regulating valve with built-in check valve feature, check valve, vacuum breaker, pressure relief valve and gate valve.

2. 1-1/2-Inch (Greater if Indicated) Make-up Assembly:

a. Automatic feed line in parallel with manual feed line.
b. Automatic feed line with the following in direction of flow:

(a) Pressure regulating valve with built-in check valve, vacuum breaker and pressure relief valve.

c. Manual feed line with gate valve and check valve.
d. Gate valve common to both manual and automatic lines on each side of the parallel system.
e. Connect chilled water and hot water make-up line to pipe which connects air separation device to compression tank assembly. Pipe size from make-up water connection to air separation device shall be same size as make-up water line.

END OF SECTION 23 05 24

SECTION 23 05 29
HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this Section.

1.2 SCOPE

A. Provide all angles, brackets, clamps, anchors, inserts, rods, braces, frames, hangers nuts and bolts, and other miscellaneous steel and hardware items as may be required for the proper support of equipment, piping systems, HVAC systems, plumbing systems and fire protection systems.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Piping systems.
2. Duct systems.
3. Equipment items.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Provide specific data on hangers, stands, clamps, rollers, guides, shields, anchors and their proposed application. Submit detailed shop drawings, showing method of support and anchoring for all piping and equipment as follows:

1. Piping Systems:
2. Scaled single line piping plans superimposed on structural construction drawings. Scale shall be minimum 1/4" = 1'-0". Piping which is three inch (3") diameter and smaller may be omitted from these shop drawings. Drawings shall clearly indicate the location and type of each and every insert, hanger, stand, support, guide, isolator and anchor; and shall also indicate the size, type locations and method of attachment for all miscellaneous structural steel required.
3. Sectional drawings, sketches and other details as may be required to clearly communicate the method of support, anchoring, guiding and vibration isolation.
4. Show details of any typical floor or wall penetrations including: riser clamp, pipe sleeve, and provisions for water stop to prevent the water travel between penetrations.

1.5 INDUSTRY STANDARDS

A. Where compliance with an industry, society or association standard is specified or indicated, certification of such compliance shall be submitted with shop drawings.

1.6 MANUFACTURER

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. F&S Manufacturing Corp.
2. Fee and Mason Manufacturing Co.

PART 2 - PRODUCTS

2.1 HANGERS

A. Hangers In Contact With Copper Piping: Shall be copper plated or teflon coated. Hangers shall be Fed. Spec. WW-H-171E, Type 9. Acceptable: Grinnell Fig. 97 or 97C, or equivalent.

B. Hangers (other than in Contact with Copper Piping): Shall have manufacturer's standard finish. Hangers shall be of the following types:

1. Pipe 3" and Larger: Fed. Spec. WW-H-171E, Type 1. Acceptable: Grinnell Fig. 260 or equivalent.
2. Pipe 2-1/2" and Smaller: Fed. Spec. WW-172E, Type 6. Acceptable: Grinnell Fig. 104 or equivalent.

2.2 ISOLATORS

A. Refer to the Section, if included in this Division, which describes vibration isolation.

2.3 PIPE ROLLER STANDS

A. Shall be Fed. Spec. WW-H-171D, Type 47. Acceptable: Grinnell Fig. 171, or equivalent.

2.4 PIPE ROLLER HANGERS

A. Pipe Roller Hangers: Shall be Fed. Spec. WW-H-171E, Type 42. Acceptable: Grinnell Fig. 171, or equivalent.

2.5 PIPE ALIGNMENT GUIDES

A. Acceptable: Grinnell Fig. 256, or equivalent.

2.6 PIPE RISER CLAMPS

A. Pipe Riser Clamps: Shall be Fed. Spec. WW-H-171D, Type 8.

2.7 INSULATION SHIELDS

A. Shall be Fed. Spec. WW-H-171D, Type 41. Acceptable: Grinnell Fig. 167, or equivalent.

2.8 BEAM CLAMPS

A. Fed. Spec. WW-H-171D, Type 29. Acceptable: Grinnell Fig. 292 with links, or equivalent.

2.9 INSERTS

A. Preset Type: Malleable iron with removable interchangeable nuts having lateral adjustment of not less than one and five-eighths inches. Continuous inserts shall have a capacity of 2,000 lb. per foot and shall be hooked over reinforcing. Acceptable: C-B Universal Fig. 282; Unistrut Products Co., P3200 or P3300; B-Line Systems, Inc., Series B- 32.1, or equivalent.

2.10 ROD

A. Carbon steel, black threaded bolt ends or continuous thread, sized with safety factor of five (5). Acceptable: Grinnell Fig. 140 or 146, or equivalent.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to Section entitled "General Mechanical Provisions". All inserts, fasteners, hangers and supports shall be installed in strict accordance with manufacturer's instructions.

3.2 PIPE

A. General: Hangers shall be spaced to prevent sag and to permit proper drainage. All piping shall be run parallel with the lines of building, unless otherwise indicated on drawings. The hanger spacing and placement shall be such that after the covering (insulation and finish) is applied, there will be not less than 1/2" clear space between finished covering and other surfaces, including the finished covering of parallel adjacent pipes. Hangers for insulated pipes shall be sized to encompass the insulation, finish and metal insulation shield (a metal insulation shield shall be provided for each hanger or support). Vertical piping shall be supported with pipe riser clamps at every floor penetration, unless specifically indicated otherwise on the drawings. Hangers and supports shall not be placed at greater than the following intervals:

1. Pipe 1" and Smaller: Eight foot (8') centers and not more than two feet (2') from a change in direction (offsets, elbows, and tees).
2. Pipe 1-1/4" through 2-1/2": Ten foot (10') centers and not more than two feet (2') from a change in direction (offsets, elbows and tees).

3. Pipe 3" and Larger: Fourteen foot (14') centers and not more than two feet (2') from a change in direction (offsets, elbows, and tees).

3.3 EQUIPMENT

A. Equipment supports shall be as otherwise indicated on the drawings or in the specifications.

3.4 DUCTWORK

A. Refer to Sections describing ductwork.

3.5 POWDER (GUNPOWDER) ACTUATED FASTENERS

A. Not allowed.

END OF SECTION 23 05 29

SECTION 23 05 48
VIBRATION ISOLATION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide vibration isolation supports for all equipment and piping as may be required to prevent transmission of vibration to building structure. This shall include air handling units, fans, piping, pumps and similar items.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the drawings and specifications.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Submittal data shall show type, point loading information, size and deflection of each isolator proposed and any other information as may be required for the Engineer to check isolator selections for compliance with specifications. Include clearly outlined procedures for installing and adjusting the isolators.

1.5 MANUFACTURERS

A. Products of the following manufacturers will be acceptable, provided they comply with all of the requirements of this specification: Consolidated Kinetics; Mason Industries; Amber-Booth; Keflex; Flexonics; Vibration Eliminator Company or equivalent. Any model numbers listed are from one or more of these manufacturers and are given to provide an example of item(s) required.

1.6 OTHER REQUIREMENTS

A. All vibration isolation equipment shall be both recommended by the manufacturer and approved by the Engineer for each particular application on this project.

PART 2 - PRODUCTS

2.1 BASIC REQUIREMENTS

A. Unless otherwise noted, spring type vibration isolators shall be used for all motor driven equipment. It shall be the responsibility of isolation manufacturer to determine the amount of spring deflection required for each isolator to achieve optimum performance, prevent the transmission of objectionable vibration and meet noise criteria referenced herein.

2.2 CORROSION PROTECTION

A. Steel components shall be phosphated and painted. All nuts, bolts and washers shall be zinc-electroplated. Structural steel bases shall be thoroughly cleaned of welded slag and primed with zinc-chromate or metal etching primer.

B. All isolators exposed to weather shall have steel parts PVC coated or hot-dip galvanized. Aluminum components shall be etched and painted. Nuts, bolts and washers may be zinc-electroplated.

2.3 BASIC ISOLATORS

A. General: Unit designations indicated are Architect/Engineer designations. Each of the following basic isolators may not be applicable to a specific installation application. See PART 3, "EXECUTION".

B. Flexible Pipe Connectors: Same internal diameter as the pipe in which the connector is installed (not necessarily internal diameters of inlets or outlets of equipment).

1. Both recommended by the manufacturer and approved by the Architect/Engineer to be suitable for handling the conveyed fluid at all conditions (maximums and minimums of temperatures, pressures, velocities, etc.) encountered for each particular application.
2. Of proper design to absorb the combination of vibratory and/or expansion or contraction motions (lateral and/or axial and/or angular) encountered at each installation point (for example, do not use hose type where axial motion is encountered at the installation point unless so recommended by the manufacturer and approved by the Architect.
3. Stainless steel bellows type (Unit SSB): Heavy duty steel restraining rods and spacers; laminated steel bellows; steel flanges; permit axial, lateral and angular movement; rated to withstand 180^{o}F operating temperature and 150 psig working pressure for chilled water; 250^{o}F operating temperature and 150 psig working pressure for heating hot water; similar to Keflex Series 151 or 301.
4. Stainless steel hose type (Unit SSH): Rated to withstand 180^{o}F operating temperature and 150 psig working pressure; have flanges except 2-1/2 inch and smaller sizes may have screw type fittings installed with a union at one end or with screw-on flanges at both ends; net flexible lengths shall be at least 6 pipe diameters for pipe up to 5 inch ID and not less than 36 inches for pipe 6 inch ID and greater; corrugated bellows with stainless steel wire braid restraining sheath; similar to Flexonics Type RW, RF or Series 400, Mason Type BSS, Keflex Series SSH.

C. Acoustic Seals (Unit AS): Consist of an S-shaped molded synthetic rubber seal attached with stainless steel clamps to the pipe wall sleeves and to carrier piping. Wall sleeves shall be two pipe sizes larger than the carrier pipe and/or its insulation. Amber-Booth Type 301.

D. Neoprene Pads (Unit NP): Waffle or ribbed pattern neoprene pads shall be fabricated from 40-50 Durometer neoprene. Mason Type W.

PART 3 - EXECUTION

3.1 GENERAL

A. All isolators shall be installed in strict accordance with the manufacturer's instructions and shall be properly adjusted prior to requesting final inspection or the performance of any vibration testing specified.

B. Each item of equipment (machinery, piping, etc.) which is provided with vibration isolation equipment shall rest in its intended, proper operating position (i.e. exactly level, etc.) after installation of vibration isolation equipment. Approval of such vibration isolation equipment by Architect/Engineer shall not relieve the Contractor of this responsibility.

C. Equipment which is specified to rest on concrete housekeeping pads shall have Unit NP pads unless otherwise indicated.

3.2 PUMPS, HORIZONTAL BASE MOUNTED

A. Flexible pipe connectors (Unit SSB).

3.3 CHILLERS, WATER COOLED

A. Mount on neoprene pads (Unit NP) on concrete housekeeping pad.

B. Flexible pipe connectors (Unit SSB) at CHW and CW connections.

3.4 MANUFACTURER'S SUPERVISION

A. The Contractor shall include in his price the cost of the vibration isolation manufacturer or his qualified representative for providing such supervision as may be necessary to assure correct installation and adjustment of the isolators. Upon completion of the installation and after system is put into operation, the manufacturer or his representative shall make a final inspection and submit his report to the Engineer in writing certifying the correctness of installation and compliance with approved submittal data.

END OF SECTION 23 05 48

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SECTION 23 05 53
IDENTIFICATION OF PIPING SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide complete identification of the mechanical systems including piping, valves and equipment as noted herein.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Piping and the interconnected equipment and component items for the following systems:

a. Chilled water.
b. Condenser water.

1.4 APPLICABLE PIPING AND RELATED ITEMS

A. Piping and interconnected equipment and component items for the following systems shall be identified. Identification of the following systems shall not preclude the identification of other systems where identification of such other systems may be specified in other sections. Systems requiring identification as work of this section are:

1. Chilled water.
2. Condenser water.

1.5 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Provide schedule of colors, lettering, tagging, handling and similar items to clearly identify proposed method of identification for mechanical systems.

1.6 DIMENSIONS

A. Pipe dimensions as used in this section refer to the total outside dimensions (diameters) of both the pipe and its insulation (if any).

PART 2 - PRODUCTS

2.1 GENERAL

A. Comply with ANSI A13. 1-1975, "Scheme for Identification of Piping Systems" and OSHA requirements, or as otherwise indicated.

B. Acceptable Manufacturers: W. H. Brady Co., 2223 West Camden Road, Milwaukee, WI 53201; Seton Name Plate Corporation, 592 Boulevard, New Haven, CT 06505, or equivalent.

2.2 MARKERS, BANDS, TAGS AND LABELS

A. Markers: Must have approved color coded background, proper color of legend in relation to background color, approved legend letter size, approved length and flow arrow indicator.

1. Pipes 3/4" through 5" O.D.: Seton "Setmark" Type SNA marker or equivalent.
2. Pipes 6" O.D. and Greater: Seton "Setmark" Type STR marker or equivalent.

B. Bands: Color coded in minimum widths of 2-1/4" for pipe through 12" O.D. and 4" for pipe 14" O.D. and greater. Brady B-500 Vinyl Cloth, B-350 PermaCode or B-946 Outdoor Film or equivalent as applicable.

C. Valve Tags: Each tag shall designate appropriate service and valve number. Be securely attached with meter seals with 4-ply 0.018 copper smooth wire, or brass "S" hooks, or brass jack chain in a manner to allow easy reading. Provide either of the following types:

1. Brass Type: Minimum 19 gauge polished brass; 1-1/2" min. diameter. Acceptable: Seton Style 250-BL or equivalent.
2. Aluminum Color Coded Type: Anodized aluminum; 2": min. diameter. Acceptable: Seton Style 2070 or equivalent.
3. Aluminum Alloy Type: 16 gauge sheet aluminum: depressed type letters filled with black enamel. Face and periphery of satin finish Alumilite, Alcoa 204A2 or equal, free from burns and scratches. Seton Type 4 or equivalent.
4. Fiber Glass Type: 1/16" thick glass fiber reinforced resin. 2" x 2" size of 2-1/2" x 9" size as necessary to identify item. Brady Series No. 2297 or equivalent.

D. Labels: Provide either of the following types:

1. Plastic Type: Outdoor grade acrylic plastic to withstand weather, abrasion, grease, acid, chemical and other corrosive conditions; 1/16" min. thickness. Sized 3/4 x 2-1/2, 1 x 2-1/2, 1 x 3 or 1-1/2 x 4 as necessary to identify item. Seton "Setonite" or equivalent.
2. Aluminum Type: Engraved, flexible, 0.020" thick aluminum. Sized 3/4 x 2-1/2, 1 x 3, 1-1/2 x 4 or 3/6 as necessary to identify item. Seton No. 06505 or equivalent.

E. Provide continuous lengths of magnetic identification tape noting particular system above all underground piping at 12” below grade.

PART 3 - EXECUTION

3.1 GENERAL

A. Apply only after completion of insulation, painting and cleaning work so that final identification is not disfigured by such other work.

B. Coordinate with actual composition and operating temperatures of surface on which identification is to be placed so that proper permanent adhesion of markers and labels to surface is obtained.

C. Locate marking and banding where practical such that groups of pipe are identified at similar location for ease of visual tracking. For example, mark and band parallel runs of pipe which are side-by-side at the same general place.

D. Small pipes less than 3/4" diameter may be identified with tags similar to those specified for valves.

E. Adhere or affix all identification items permanently except where removal may be necessary for maintenance or service.

3.2 MARKERS AND BANDS

A. Provide on piping as follows:

1. Pipe Concealed in Inaccessible Locations (e.g., Chases, Underground): No identification required.
2. Pipe Concealed in Accessible Locations (e.g., Ceiling Plenums):

    a. Markers every 20 feet of pipe length. Bands every 15 feet of pipe length.

3. Pipe Exposed in Equipment Rooms:

    a. Markers every 15 feet of pipe length for pipe through 12 inches O.D. and every 30 feet for pipe 14 inches O.D. and greater.

4. Bands every 10' of pipe length for pipe through 12" O.D. and every 25' for pipe 14" O.D. and greater.
5. Exterior Pipe, Exposed: No identification required unless otherwise indicated.

3.3 VALVE TAGS

A. Valve tags shall be installed on the following items:

1. All motorized valves (except those valves associated with direct control of flow to air handling apparatus whereby the valve may be identified by reference to the item of equipment it serves).
2. All fire protection system valves located in mains and branches (except those valves in fire hose cabinets).
3. All manual valves which perform functions other than isolation of an equipment item for servicing. This includes, but is not limited to, valves in valve stations, remote locations

where use is not evident due to proximity of equipment or other piping, and similar locations.
4. Small piping (other than domestic water) where markers are impractical.
5. Small but critical equipment items on which it is impractical to install labels.

3.4 VALVE TAG LISTS

A. Prior to substantial completion, provide a complete list of all valves having tags. Indicate the following on such list:

1. Valve size.
2. Valve location.
3. Valve type.
4. Service application.
5. Valve manufacturer and model number.
6. Pressure class and allowable working pressure.

3.5 LABELS

A. Provide labels of proper size on mechanical system equipment including but not limited to, pumps, chillers, tanks, major piping components such as air separators, air handling equipment, fans, control panels, terminal units, flow stations, reheat coils and similar items.

3.6 COLORS

A. Colors for piping systems and equipment which are required to be painted shall be as follows for those systems which may be applicable to this project:

1. Domestic Cold Water: Medium green enamel with domestic cold water legend.
2. Domestic Hot Water and Domestic Hot Water Recirculation: White insulation with yellow tape or metal bands with domestic hot water (domestic hot water recirculation) legend.
3. Chilled Water Piping: Blue mastic with blue tape or bands with chilled water supply (or return) legend.
4. Heating Hot Water Piping: Burnt orange with heating hot water supply (or return) legend.
5. Gas Piping: Yellow with gas legend.
6. Compressed Air Piping: Light grey with compressed air legend.
7. Fire Protection Piping: Red with fire line legend.
8. Sprinkler Piping: Red with sprinkler legend.
9. Condenser Water Piping: Tan with condenser water supply (or return) legend.
10. Roof Drainage Piping: Light green with storm water legend.
11. Compressed Air Piping: Black with compressed air legend.
12. Natural or L.P. Gas Piping: Yellow with gas legend.
13. High (or Medium or Low) Pressure Steam Supply Piping: White insulation jacket or aluminum jacket with yellow tape or bands with HP (MP, L.P.) steam legend.
14. High (or Medium or Low) Pressure Steam Condensate Piping: White insulation or aluminum jacket with yellow tape or bands with HP (MP, LP) steam legend.
15. Equipment Hot Vent Piping (Below 100^{o}F): Light brown with vent legend.
16. Equipment Hot Vent Piping (Above 100^{o}F): Light brown tape or bands over insulation or metal jacket with vent legend.
17. Vacuum (Housekeeping): Light olive green with vacuum legend.
18. Fuel Oil (Supply, Return, Vent) Piping: Yellow with fuel oil legend.

19. Generator Exhaust Piping:

    a. Insulated: White insulation with yellow tape or band with generator exhaust legend.
    b. Bare Pipe and Fittings: Silver (suitable for extra high temperature application).

20. Sanitary Sewer and Vent Piping: Brown with sanitary sewer (vent) legend.
21. Electrical conduit (not specified as painted in other divisions of these specifications): Silver.

B. Identification: Coordinate colors and finishes with pipe identification.

END OF SECTION 23 05 53

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SECTION 23 05 93
PERFORMANCE VERIFICATION, PRELIMINARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Put all work in a state of readiness for final performance verification.

B. Final performance verification shall not begin until the systems are complete and operable in all respects and all related building systems are complete.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

B. Refer to the section which describes "Performance Verification, Final".

PART 2 - PRODUCTS

This section not applicable.

PART 3 - EXECUTION

3.1 WATER SYSTEMS

A. Prepare each water system for balancing in the following manner:

1. Open all valves to the full position, including coil stop valves; close bypass valves, and open return line balancing cocks.
2. Clean all strainers.
3. Examine fluid in each system to determine that it has been treated and is clean.
4. Check pumps for proper rotation.

B. Check expansion tanks for full capacity of water and the absence of air lock.

C. Check all air vents at high points of system for proper installation and free operation. Remove all air from circulating system.

1. Set all temperature controls for full heat or full cooling (as applicable) from all coils.
2. Check for proper operation of any automatic bypass valves.

3.2 ADDITIONAL REQUIREMENTS

A. Complete Installation: The Contractor shall complete the equipment and system installation to the satisfaction of the Engineer (who will be the sole judge of its state of readiness) prior to advising, the writing, that final performance verification is ready to begin. The Contractor is hereby advised that the Certificate of Substantial Completion will not be issued prior to the completion of final performance verification work and that he should therefore, schedule all other work accordingly allowing no less than 60 days for completion of final performance verification.

B. Clean, Flush and Fill Systems: The Contractor shall include the cleaning, flushing, filling, and venting of all hydronic systems; the setup, check-out, and startup of chemical treatment systems; and the setup, checkout and startup of all equipment as work to be complete prior to the start of final performance verification.

C. Correction of Defects: The Contractor shall promptly and properly correct all defects in workmanship, material, installation and equipment of which he is aware prior to requesting that final performance verification work begin. Once the final performance verification work has begun, the Contractor shall promptly correct all defects in workmanship, materials, installation, and equipment as they are called to his attention by Engineer.

D. Scheduling and Coordination: The Contractor shall be responsible for proper scheduling and coordination of work involved in preliminary performance verification. This shall include, but is not necessarily limited to the timely provision of: mechanics, tools, equipment, correction of defects, equipment manufacturer's representatives, test modules, and all other items which may be required.

E. Report: Submit a written report describing and certifying in detail all preliminary performance verification items and tasks that have been performed. Approval of this report by the Architect/Engineer will precede final performance verification.

END OF SECTION 23 05 93

SECTION 23 05 94
PERFORMANCE VERIFICATION, FINAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide the services of an independent test and balance agency to verify the performance of the complete heating, ventilating and air conditioning systems as described by Division 23. Performance verification shall be accomplished by established testing and balancing procedures as described in this section.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

1.4 TEST AND BALANCE AGENCY

A. Quality Assurance that T & B Agency is certified by to be either AABC or NEBB. Agency must have been in business a minimum of three years or show that T & B work has been performed on a minimum of ten projects similar in size. Documentation must be submitted to Engineer and SLPS for approval prior to starting any T & B procedures.

1.5 CONTRACTUAL RELATIONSHIP

A. Performance verification shall be performed as a service of the T & B Agency directly to the Contractor with no other subcontractors as part of the agreement.

B. Performance verification is specified in this Division 23 only because it relates predominantly to Division 23 work. However, the inclusion in this Division 23 of this section covering performance verification shall not preclude the contractual agreement of the T & B Agency from contracting directly to the Contractor with no other subcontractors as part of such agreement.

1.6 AGENCY APPROVAL

A. Submit the name and qualifications of the proposed T & B Agency to the Engineer for approval within thirty (30) days of Notice to Proceed.

B. Include AABC National Project Certification Performance Guaranty.

1.7 WORK INCLUDED

A. The T & B Agency shall provide all labor, supervision, professional services, tools, test equipment and instruments (except as otherwise specified) to perform the following work and all other work of this section:

1. Review the automatic temperature control and equipment specifications for their respective and combined effects on the testing and balancing procedures for the hydronic systems.
2. Where in the opinion of the T & B Agency conditions may exist in the system design or construction that may have the potential of adversely affecting system performance, then the T & B Agency shall identify the condition and submit in writing recommended correctives for consideration by the Engineer.
3. During construction, review those shop drawings which have relevance to performance verification to confirm that the required piping and equipment, and their respective specialties and accessories such as gauges, valves, etc., are properly selected, sized and located to permit proper and complete testing and balancing to be accomplished.
4. T & B Agency will perform a minimum of three (but not less than once per month) field investigations while HVAC Systems and all subcomponents are being installed. Before any field investigations are performed by T & B Agency, they must notify the Engineer and SLPS's T & B acting representative of date and time of field investigation. Upon completion of field investigation, a written report must be submitted to the Engineer and SLPS's T & B acting representative.
5. Perform a complete hydronic test and balance of all air conditioning water systems shown and described on the Construction Documents and as further described herein.
6. Submit Equipment Test and Systems Balance Report.
7. T & B Agency must witness and certify all duct leakage test rates and pressure tests on any piping performed by Mechanical Contractor. All tests certified by T & B Agency must be recorded and submitted in writing to Engineer and SLPS's T & B acting representative.

1.8 GUARANTY

A. Warranty: The T & B Agency must provide a "National Project Performance Guarantee" as prescribed by AABC or NEBB testing procedures and standards that state AABC or NEBB will assist in completing the requirements of the Contract Documents if the T & B Agency fails to comply with the Contract Documents.

B. Additional Tests: Within 60 days of completing any and all T & B "Total System Balance" work and additional testing, adjusting, and balancing is needed to verify report parameters are being maintained, any and all work will be done at the T & B Agency's expense. Any test the T & B Agency is asked to perform will be submitted in writing to the Engineer and SLPS's T & B acting representative.

C. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter load occupancy and outside air conditions, the T & B Agency must perform the following tests: summer occupancy and outside design load conditions; winter occupancy and outside design load conditions. Before the T & B Agency performs any opposed seasonal test, he must first notify the Engineer and SLPS's T & B acting representative in writing. Any and all opposed season test performed by T & B Agency will be at their expense. Any and all opposed season test performed by the T & B Agency must be recorded and submitted to Engineer and SLPS's acting T & B representative.

PART 2 - PRODUCTS

2.1 GENERAL

A. The tangible product of this section shall include the reports and documentation necessary to verify the systems' performance.

2.2 REPORT

A. The T & B Agency shall in the course of his work record the information herein specified. Recorded test data shall be at the final balanced condition for each system. Recorded data shall be arranged by system using the appropriate designation as established on the Construction Documents. Four (4) copies of the final report signed, bound and indexed shall be submitted to the Engineer for his approval or comments.

B. T & B Agency's testing, adjusting, and balancing report must be submitted on AABC or NEBB registered forms approved by Engineer and SLPS. All report forms must be certified by T & B Agency's National Certification stamp. All Test, Adjust, and Balancing forms must be approved by SLPS before the commencement of any T & B work.

C. Where actual measurements recorded for the final balance show deviations of more than 10% from the design, the T & B Agency shall note same in the report and submit recommendations for corrective action to the Engineer for his consideration.

D. In those cases where recorded data can be reasonably interpreted to be inaccurate, inconsistent and/or erroneous, the Engineer may request additional testing and balancing. The T & B Agency shall at no additional cost perform such retesting and rebalancing as directed by and in the presence of the Engineer.

E. Where, in the opinion of the T & B Agency, there is excessive vibration, movement or noise from any piece of equipment, pipes, etc., the T & B Agency shall note same in the report and submit recommendations for action to the Engineer.

F. Test Data: Include the following data in the Systems Test and Balance Report:

1. Motors:

   Manufacturer
   Model and serial number
   Rated amperage and voltage
   Rated horsepower
   Rated RPM
   Corrected full load amperage
   Measured amperage and voltage
   Calculated BHP
   Measured RPM
   Sheave size, type and manufacturer

2. Pumps:

   Manufacturer
   Model or Serial number, impeller size
   Rated RPM, measured RPM

Rated head, measured head
Rated pressures
Measured discharge pressure (full flow and no flow)
Measured suction pressure (full flow and no flow)
Design GPM
Initial/Final Measured GPM
Operating head
Operating RPM

G. Other Report Requirements: Where any systems have equipment or components which are not covered by the above, then the Final Test and Balance Report shall include the following data as applicable to such equipment or systems to confirm actual operation:

1. All inlet and outlet areas.
2. All applicable pipe sizes.
3. All fluid velocities, flow rates, temperatures and pressures at appropriate locations.
4. All speeds.
5. All voltage and ampere ranges.
6. Descriptions of each test method used.
7. All name plate data.

2.3 INSTRUMENTATION

A. All test and balance equipment and instruments to be furnished by the T & B Agency shall have been calibrated within six (6) months of use on this work. A list of equipment and instruments to be used shall be submitted to the Engineer prior to commencing test and balancing operations and shall include equipment and/or instruments, name, manufacturer, serial number and certification of last calibration date. Instruments without calibration adjustment capability shall be accompanied with manufacturer's certification of accuracy. Test and balance equipment and instruments furnished by the Contractor to the T & B Agency shall be accompanied with certification as required above. The T & B Agency shall be responsible for the protection from damage due to accident, abuse or misuse, all equipment and instruments provided by the Contractor, and shall return same in good working condition at the completion of the test and balance work to the Contractor. The T & B Agency shall repair at his expense to original condition and accuracy or replace with like equipment and instruments damaged in the work.

2.4 LOGS AND FORMS

A. Logs and forms shall clearly indicate following:

1. All inlet and outlet areas.
2. All applicable pipe sizes.
3. All fluid velocities, flow rates, temperatures and pressures at significant locations (e.g., fluid pressures before and after each pump, temperatures and pressures at supply and return headers and at chiller inlets and outlets, etc.).
4. All motor ampere ranges.
5. Descriptions of each test method used.

PART 3 - EXECUTION

3.1 GENERAL

A. Load Conditions: All testing and balancing of systems shall be undertaken with maximum attainable load. Testing and balancing of all air handling systems shall be accomplished with ceiling tile in place and enclosing partitions and doors erected.

B. Observe all equipment and exposed piping for noise, movement or vibrations under normal operating conditions and report excesses to the Engineer and Owner.

3.2 PERFORMANCE VERIFICATION, PRELIMINARY

A. Refer to specification section titled “Performance Verification, Preliminary”.

3.3 PROTECTION OF WORK

A. The Contractor shall protect all mechanical devices during the testing and balancing period. The activities of the T & B Agency will include but not be limited to the adjustments of designated balancing devices including; the adjustment of balancing valves, or similar devices. The existence of the T & B Agency shall not relieve the Contractor of his responsibility for the complete operation of the mechanical systems in conformance with the contract documents.

3.4 CORRECTION OF WORK

A. The Contractor shall at no additional cost to the Owner rectify discrepancies between the actual installation and contract documents when in the opinion of the T & B Agency the discrepancy will significantly affect system balance and performance.

3.5 COORDINATION AND ASSISTANCE

A. The Contractor shall assist the T & B Agency by providing all labor, equipment, tools and material required to operate all of the equipment and systems necessary for the testing and balancing of the systems and for the adjustment, calibration or repair of all electric or pneumatic or automated control devices and components. These services shall be available on each working day during the period of final testing and balancing. The Contractor shall assist the T & B Agency by arranging to have all ceilings, partitions, windows, and doors installed prior to the scheduled commencement of balancing within each specified area.

B. Coordination: The installing mechanical and controls contractor must provide an approved factory authorized service representative to assist and support the T & B Agency in the operation and testing of all HVAC Systems, Controls, and EMS Systems and all its subcomponents to ensure Total System Balance can be achieved without lengthy delays.

C. The Contractor shall provide to the approved T & B Agency a complete set of plans and specifications and an approved copy of all heating, ventilating and air conditioning equipment shop drawings.

3.6 HYDRONIC SYSTEMS

A. The testing and balancing shall include, but is not necessarily limited to, the following requirements as applicable to either or both the hydronic systems and steam systems:

1. Prior to testing and balancing of each system check all flow meters for proper installation, calibration and accuracy.
2. Measure and adjust pump flow capacity to proper quantity.
3. Adjust flow through chillers.
4. Balance system flows.
5. Coordinate equipment operation and output performance with the manufacturer's representative. Record inlet and outlet temperatures.
6. Mark or otherwise record settings of adjustable balancing devices which provide the design flow requirement.
7. For each hydronic system record flow rate, pump inlet and outlet pressures and motor amperage for each pump for each increment of system flow rate provided by the pumping/piping configuration. Variable speed pumps shall operate as constant volume pumps at maximum speed for purposes of this record.

3.7 OTHER TESTING REQUIREMENTS

A. T & B Agency must record any and all HVAC System equipment name plate data, such as Water Pumps of various types and Chillers, and their subcomponents as set fort in AABC and NEBB national standards and testing procedures.

B. T & B Agency will measure and record all electrical performance data on all HVAC Equipment and subcomponents on appropriate T & B forms approved by Engineer and SLPS.

C. T & B Agency will verify and record all automatic control devices are functioning properly.

D. T & B Agency will perform and record sound and vibration measurements on any HVAC equipment and subcomponents directed by the Engineer and SLPS. All sound and vibration measurements must be recorded on appropriate T & B sound/vibration forms approved by Engineer and SLPS.

END OF SECTION 23 05 94

SECTION 23 07 00
INSULATION, HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide all work necessary to insulate all equipment, piping, ducts and other items related to the piping and duct systems.

1.3 RELATION TO OTHER WORK

A. Refer to the section, General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Piping systems.
2. Duct systems.
3. Cooling equipment.

C. Vessels, tanks, stacks, and other items which contain or convey fluids which are at such temperatures as to create condensation or surface temperatures which are hazardous or where heat loss or gain prohibits proper system operation.

1.4 SHOP DRAWINGS

A. General: Refer to the Section entitled "General Mechanical Provisions". Shop drawings shall contain complete descriptive and engineering data, including flame spread and smoke developed ratings (ASTM E84 test method) on all materials and adhesives. Where finishes, covers, or jackets are specified, provide complete data on same. Shop drawings shall contain specified information on: densities, conductivities, conductances, or resistances as required to establish conformance with the specified values or materials.

B. Industry Standards: Where compliance with an industry, society or association standard is specified or indicated, certification of such compliance shall be submitted with shop drawings.

C. Commencement of Work: Submit shop drawings before any work is commenced.

1.5 STORAGE OF MATERIALS

A. Do not store fiberglass insulation within the building until it has been "dried in". If no other dry space is available and this insulation must be installed or stored before the building is "dried in" and completely enclosed, provide polyethylene film cover for protection.

1.6 COMPLIANCE WITH CODES AND STANDARDS

A. Applicable Codes: The total insulation system including insulation, sealant, finishes, etc., shall comply with or exceed all code requirements.

B. NFPA: All materials and adhesives used shall conform to the requirements of NFPA 90A as to flame spread and smoke developed ratings.

1.7 DEFINITIONS AND TERMINOLOGY

A. Terminology: Throughout this section, insulation products may be described as regards the location, surface or other point at which they are to be applied. Except in special cases (where a detailed indication or description will be given), the majority of conditions can be defined in whole or in part by use of (but not necessarily limited to) any or all of the following words:

1. "Internal" or "External".
2. "Interior" or "Exterior".
3. "Concealed" or "Exposed".
4. "Protected" or "Unprotected".

B. Definitions: Wordage used to describe locations, surfaces or other points or conditions shall be defined as follows as related to this section. Where the ascertainment or determination of locations, surfaces and other conditions is obvious from the intent of use of the item (e.g., roof-mounted ductwork, underground piping, etc.) or from other information, then the following words may not be required. If any ambiguity should occur, provide bid based on the most severe condition; however, obtain clarification from Architect/Engineer prior to installation:

1. "Internal" and "External": Relates to an item or its surface which is to be insulated or uninsulated. Does not relate to the confines of the building, structure or other entity in which the item is located. (Examples: internal/external surfaces of ductwork, pipe, air handling units or other such items.)
2. "Interior": Relates to the location of an item as to whether the item is within a heated, ventilated, air conditioned or otherwise controlled environment of the building, structure or other entity in which the item is located. "Interior" is always "Protected". (Examples(s): Interior ductwork, interior piping, interior air handling units.)
3. "Exterior": Relates to the location of an item as to whether the item is outside (i.e., exterior to) a heated, ventilated, air conditioned or otherwise controlled environment of the building, structure, facility or other entity which the item serves or relates. "Exterior" generally means that the item is surrounded by the ambient outside environment. "Exterior" is considered "Unprotected" unless otherwise described. (Examples(s): exterior rooftop air handling units, exterior ductwork, exterior cooling tower.)
4. "Concealed" and "Exposed": Relates to the visibility of an item. "Concealed" implies out-of-sight from normal view by an occupant, user or employee of the facility when such person is performing their normal function. "Exposed" implies that the item is readily visible by such a person when that person is performing a normal function.

(Examples(s): "Concealed interior ductwork" would be out-of-sight in a ceiling plenum, whereas "exposed interior ductwork" would be readily visible in a mechanical equipment room or in a room which intentionally had no ceiling system.)

5. "Protected" and "Unprotected": Relates to an exterior item which may or may not be sheltered from the outside elements but which exists in contiguous contact with the ambient environment without benefit of any direct heating, ventilating or air conditioning. (Example(s): Piping or ducts located in an open crawl space beneath a building would be "protected/concealed"; in an open parking garage such piping or ducts would be "protected/exposed". Piping or ducts on a rooftop would be "unprotected" and usually "exposed".)

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials: Materials listed are those used as basis of design; equivalent products of acceptable manufacturers will be accepted. Materials must be approved and recommended by the insulation product manufacturer for the particular application(s).

B. Flame and Smoke Ratings: Application of insulation materials may require, in many cases, that the final insulation system comply with NFPA 90A with regard to maintaining a flame spread rating of 25 or less and a smoke developed/fuel contributed valve of 50 or less. In such cases, verify that the materials comply with the indicated flame spread and smoke developed ratings.

C. Applicability: Products and manufacturers listed may not all be applicable. Use only those products and manufacturers which are indicated as being applicable to a specific insulation condition.

D. Acceptable Manufacturers: Manufacturers which are listed are those manufacturers who may make one or more of the insulation products required. Listing of a manufacturer does not necessarily mean the manufacturer is approved for all applicable insulation conditions. Each listed manufacturer must still comply with the specific requirements of each insulation condition to be acceptable for the particular application. Acceptable manufacturers of insulation-related products include (but are not necessarily limited to) the following: Armstrong; CertainTeed; Childers Products Co.; Knauf; Manville; Owens-Corning; Pittsburg Corning; Rubatex; Upjohn Co.; Duracote Corporation; Ferro Corporation; Dow Corning Corporation; Duro Dyne Corporation; Goodloe E. Moore, Inc.; 3M Co.; United McGill Corporation, Vimasco Corporation; Foster; Gustin-Bacon; Nomaco Inc.; Insulcoustic; Molded Acoustical Products; Lion Nokorode and other manufacturers as may be listed for a specific application.

2.2 BASIC MATERIALS

A. Cellular Glass Insulation: Preformed or block type as indicated or as applicable. Fire, water and vermin retardant; closed cell glass composition; density of 8.5-pcf. Comply with the following: ASTM C 552, "Specification for Cellular Glass Thermal Insulation"; Military Specification MIL-I-24244B. Flame spread rating of "5" and a smoke developed rating of "0" as per ASTM E 84. Recommended temperature applications from -450°F to 1200°F when installed in accord with manufacturer's recommendations. Pittsburg-Corning Foamglas.

B. Elastomeric Insulation: Preformed (tube), roll or sheet as indicated or as applicable. Nitrile, rubber based, closed cell structure. K factor of 0.28 at 75°F. In tube, roll or sheet form of 3/4-inch thickness or less, ASTM E 84 flame spread rating of "25" or less and smoke developed rating of "50" or less. Recommended temperature applications from -40°F to 220°F when installed in accord with manufacturer's recommendations. Do not install in return air plenums unless flame spread rating and smoke developed rating are within constraints of applicable codes. Manufacturers and/or series: Armstrong "Armaflex"; Manville "Aerotube"; "Rubatex"; Gustin-Bacon "Ultra-Foam".

C. Fiberglass Insulation: Inorganic fibrous glass. Flame spread of "25" or less and smoke developed rating of "50" or less per ASTM E 84.

1. Board: Rigid or semi-rigid form, faced or unfaced as indicated. Stiffness of 475 EI, 800 EI or 1400 EI as indicated.
2. Blanket: Flexible form; faced, unfaced or coated as indicated.
3. Preformed: Jacketed or unjacketed as indicated.

D. Calcium Silicate Insulation: Preformed or block type as indicated or as applicable. Asbestos free. Rigid hydrous calcium silicate. K factor of 0.42 at 200°F. Density: 14-pcf. Flame spread rating of "0" and smoke developed rating of "0" as per ASTM E 84. Recommended temperature applications up to 1200°F. Use where indicated only on equipment and surfaces which generate heat; do not use as a cold-surface insulation.

2.3 INSULATION PRODUCTS, BASIC

A. Type PI-1: Pipe insulation, preformed cellular glass. Pittsburg-Corning "Foamglas" or equivalent.

B. Type PI-2: Pipe insulation, preformed jacketed fiberglass. Jacketed with factory-applied kraft reinforced foil vapor barrier jacket. Jacket closure system of double pressure-sensitive adhesive on longitudinal joints; self-sealing butt strips at circumferential joints; provide positive vapor barrier seal. Thermal conductivity (K) of 0.24 at 100°F. Owens-Corning Fiberglas ASJ/SSL-II; Manville Micro-Lok with AP-T Plus jacket; CertainTeed 500 Snap-On; or equivalent.

C. Type PI-3: Pipe insulation, preformed unjacketed fiberglass. Suitable for field-jacketing. Thermal conductivity (K) of 0.23 at 100°F. Owens-Corning Fiberglas No-Wrap, Manville Micro-Lok, or equivalent.

D. Type PI-4: Pipe insulation, preformed segmental rigid calcium silicate. Thickness as indicated; provide single layer where nominal pipe size allows; provide "factory nested" double layer when nominal pipe size so requires for the thickness indicated. Owens-Corning Kaylo; Manville Thermo-12; or equivalent.

E. Type PI-5: Pipe insulation, preformed elastomeric. Rubatex, Armaflex II or equivalent.

F. Type I-1: Cellular glass block insulation. Field formed, fitted and finished as required for the application. Pittsburg-Corning Foamglas or equivalent.

G. Type I-2: Calcium silicate block insulation. Field formed, fitted and finished as required for the application. Owens-Corning Kaylo; Manville Thermo-12; or equivalent.

H. Type I-3: Elastomeric insulation. Field formed, fitted and finished as required for the application. Armaflex, Rubatex or equivalent.

I. Type I-4: Fiberglass flexible blanket insulation. Unfinished, non-combustible, wool-like; composed of long glass fibers bonded with a thermosetting resin. Thermal conductivity (K) of 0.23 at 100°F. Applicable where indicated for boilers, vessels, breaching and stacks operating at up to 1000°F. Finished or held in place by wire ties, metal lath, lagging or as indicated. Owens-Corning Thermal Insulating Wool TIW Type II or equivalent.

J. Type DI-1: Duct insulation, fiberglass flexible blanket wrap. Composed of flexible blanket of glass fiber factory laminated to a reinforced foil kraft (FRK) vapor barrier with a minimum 2-inch taping and stapling flange on one edge. Suitable for operation at temperatures from 40°F to 250°F. Thermal conductivity of 0.31 at 75°F. Minimum density of three-quarter (3/4) pound per cubic foot. Provide in thickness of (2.2) inches unless otherwise specified as 2-1/2 or 3-inch thickness. Owens-Corning All Service Faced Duct Wrap; Manville R-Series Microlite; CertainTeed Standard Duct Wrap; or equivalent.

K. Type DI-2: Duct insulation, fiberglass semi-rigid board. Composed of resin bonded glass fibers faced with a foil scrim-kraft (FSK) reinforced laminate of aluminum foil and kraft bonded to provide a metallic surface finish vapor barrier; alternate vapor barrier facing (if specifically indicated) is an all service jacket (ASJ) of high intensity white bleached, chemically treated kraft paper reinforced with fiberglass yarn mesh and laminated to aluminum foil with fire-retardant adhesive to impart a clean, white appearance. Conductivity (K) of not greater than 0.23 at 75°F. Provide in thickness of one (1) inch unless otherwise indicated. Provide with minimum density of 3-pcf unless 6-pcf is specifically indicated. CertainTeed Industrial Insulation Board Type IB-300 (or IB-600); Manville 800 Series Spin-Glas Type 814 (or 817); Owens-Corning 700 Series Industrial Insulation Board Type 703 (or Type 705); or equivalent.

2.4 INSULATION ADHESIVES, MASTICS, SEALANTS

A. Adhesive (Type A-E1): For joints and seams in elastomeric insulation (Type I-3) not requiring weather protection. Rubatex R-373 Insulation Adhesive; Armstrong 520 Adhesive or equivalent.

B. Joint Sealant (Type JS-CG1): Non-hardening vapor barrier sealant specifically designed for use with cellular glass insulation (Types PI-1, I-1): Foster's 35-40 Foamseal Sealant, Pittsburg-Corning Pittseal 111 Sealant or equivalent.

C. Adhesive (Type A-F1): For adhering fiberglass blanket and board insulations (Types DI-1, DI-2) to metal substrate such as ductwork. Insulcoustic I-C 201, Foster 85-20 or equivalent.

D. Mastic, General Purpose (Type M-GP1): Non hardening vapor barrier general purpose mastic. For use where indicated or otherwise applicable. Foster GPM 35-00 or equivalent.

2.5 INSULATION FINISHES, JACKETS AND COVERS

A. Finishing Coating (Type FC-E1): For weather protection of elastomeric insulations (Types I-3, PI-5). Rubatex 374 coating; Armstrong Armaflex Finish or equivalent.

B. Finish Mastic (Type FM-CG1): For cellular glass insulations (Types PI-1, I-1). Waterproof, weather, acid and alkali resistant asphalt mastic coating for use in the range of -40°F to 200°F (installation must be done when in the 50°F to 120°F range). Pittsburg-Corning Pittcote 300 Vapor and Weather Barrier Finish or equivalent.

C. Finish Fabric (Type FF-CG1): For cellular glass insulations (Types PI-1, I-1). 6 x 6 meshes per inch polyester fabric for reinforcing the finish mastic. Pittsburg-Corning PC Fabric 79 or equivalent.

D. Finish Fabric, General Purpose (Type FF-GP1): Nylon membrane. For use generally with fiberglass duct insulations (Types DI-1, DI-2) at joints or seams or as may be indicated. Apply using Foster GPM 35-00 or equivalent.

E. Jacket, Underground Pipe (Type JP-CG-1): For cellular glass pipe insulations (Type PI-1, I-1) where indicated. Prefabricated laminate containing a 20 x 10 mesh asphalt impregnated glass fabric and a 1-mil thick aluminum foil sandwiched between three layers of a bituminous mastic. External jacket surface coated with a protective plastic film and internal surface with a special release paper. Apply around cellular glass pipe insulation in a cigarette type wrap with the overlap heat sealed. Seal butt joints in the same manner using a 4-inch wide seal strip of the jacketing. Irregular surfaces of the pipe system shall have the jacket's plastic film burned away prior to application of a 20 x 10 asphalt impregnated mesh which shall be sandwiched between two glove coats of finish mastic (Type FM-CG1).

F. Jacket, Pipe, PVC (Type JP-PVC): All purpose, UL-rated, white vinyl jacket, with or without self-sealing feature. Pittsburg-Corning "UNI-JAC" or equivalent.

G. Jacket, Pipe, Aluminum (Type JP-A1): Aluminum jacketing, 0.016 inches thick, type 3003 alloy, H-14 temper, circumferentially corrugated, with a continuously laminated moisture barrier of one mil polyethylene film and a protective layer of 40 lb. virgin kraft paper. Childers Products Co. "Corolon"; General Aluminum Supply Co. (Gasco); Insulcoustic "Alcorjac" or equivalent.

H. Pipe Fitting Covers, PVC (Type PFC-PVC): Insulated polyvinyl-chloride fitting covers in shapes as required; with fiberglass insulation insert. Suitable for temperature range of 0°F to 450°F. Flame spread rating of 25 or less and smoke developed rating of 50 or less when kept below 150°F. Acid, alkali and chemical resistant. Suitable for painting if required. Manville Zeston 25/50 PVC Insulated Fitting Covers or equivalent.

I. Pipe Fitting Covers, Aluminum (Type PFC-A1): Aluminum fitting covers, 0.020 inches minimum thickness, type 3003 alloy, H-14 temper prefabricated fitting covers with baked epoxy moisture barrier for pipe sizes through 24". Field fabricate fitting covers for pipe sizes larger than 24" using 0.020 inches thick aluminum roll jacketing with laminated polyethylene/kraft moisture barrier. Childers Products "Ell-Jacs", "Gore Ell-Jacs", "Tee-Jack", "End-Caps", and "Flange Jacs" or equivalent.

2.6 RELATED PRODUCTS

A. Wire (Type W-1): Dead soft, 16-gauge, stainless steel.

B. Straps (Type ST-1): Stainless steel T-304 (18-8) soft annealed with deburred edge with stainless steel wing seals. Childers Products "Febstraps" or equivalent.

C. Tape (Type T-1): High tensile strength rope stock flat back paper pressure sensitive tape. Pittsburg-Corning "PC Tape No. 25" or equivalent.

D. Screws (Type S-1): Aluminum pan head type "A" slotted #8 by 1/2-inch.

PART 3 - EXECUTION

3.1 GENERAL

A. Field Forming, Fitting and Finishing: Where preformed insulation products are indicated as being acceptable for a particular application, provide field formed, fitted and finished insulation systems if such application is more practical (such as due to size, configuration or dimensions which may be outside of the availability ranges for size, dimension and/or thickness of preformed products).

B. Pre-installation:

1. Do not apply insulation adhesives, materials or finishes until the item to be insulated has been completely installed and tested and proved tight and suitable for insulation.
2. Prepare surfaces to be clean and dry before attempting to apply insulation.

C. Insulation Shields: Provide hanger or pipe support shields of 16 gage (minimum) galvanized steel over or embedded in the insulation. Shield shall extend halfway up the pipe insulation cover and at least 6" on each side of the hanger. Securely fasten shield with pipe straps at each end.

D. Valves, Cocks and Specialties: Insulate as for the related piping system in which they are located unless otherwise indicated.

E. Factory Pre-insulated Components: Where equipment and other system components are specified in other sections to have factory installed insulation, then no additional insulation is required as work of this section unless additional non-factory-installed insulation is specifically described. Examples of such equipment and components which may not require additional insulation include, but are not necessarily limited to, boiler vessels, chiller evaporators, air handling units, airside terminal units, and similar items.

F. Minimum Thicknesses: Insulation thicknesses which are indicated are minimum thicknesses. Contractor may provide the same insulation material in greater thickness as an aid to installation and handling procedures or due to material availability and procurement considerations.

G. Branch Runouts: Branch runouts are considered to be individual supply/return pipes to individual terminal heating or cooling units (duct mounted coils, airside terminal units with heating coils, fan coil units, humidifiers, and similar small equipment). The supply/return pipe to such units is not considered to be a branch runout if the length of the supply or return pipe exceeds 12'-0" in length to the coil/unit connection.

H. Insulation for Plumbing Systems: See other sections describing insulation for plumbing systems.

3.2 INSULATION THICKNESS FOR PIPING SYSTEMS

A. General:

1. Basis: Insulation thicknesses for piping are given for insulation installed in the locations indicated. Thicknesses are based on the various conditions of temperature, usage and environment which are typically encountered.

2. Applicable Thicknesses: All thicknesses as applicable to all conditions may not be given in this section article. Where an insulation thickness for a particular application is specified to be of other thickness than may be listed in this section article, "INSULATION THICKNESSES FOR PIPING SYSTEMS", then provide the insulation in the thickness indicated in other portion of this section which specifically describes the particular insulation application and its required insulation thickness. Thicknesses for other than piping insulation are given in the specific description of the particular application or description of the particular material used.
3. Ambient Conditions: Unless otherwise indicated, ambient conditions for the purpose of describing insulation thicknesses are related to cold applications to prevent condensation or excessive heat gain (e.g., chilled water pipe, cold vessels) and are related to hot applications to prevent harm to personnel or to prevent objectionable heat loss to the environment (e.g., hot water pipe, hot vessels, hot stacks).

    a. These conditions are generally:

    Interior: 80°F and 80% RH.
    Exterior: 90°F and 80% RH.

4. Thickness Requirements: Thicknesses are given below based on the following information:

    a. General type of fluid or process involved (e.g., chilled water, hot water, steam, refrigerant).
    b. General location and, if necessary, conditions related to temperature (either or both internal or external to the insulation barrier) and ambient environment of the insulated item.
    c. Pipe size range.

B. Chilled Water Piping Systems: Fluid generally considered to be between 40°F and 65°F. Thickness is for cellular glass unless other insulation material is indicated.

Location or Description	Pipe Size (inches)	Insulation Thickness
Interior	Up to 1	1-1/2"
Interior	1-1/4 to 4	2"
Interior	6 and up	2-1/2"
Exterior	Up to 4	2-1/2"
Exterior	6 and up	3"
Underground	All Sizes	2"

3.3 CHILLED WATER PIPING SYSTEMS

A. Interior, Concealed (e.g., ceiling plenums): Insulate with prefabricated, cellular glass pipe insulation (PI-1, I-1). Butter joints with joint sealant (JS-CG1) and secure each section with not less than two wires (W-1). Finish with a layer of fabric (FF-CG1) applied between two glove coats of mastic (FM-CG1). Mastic and fabric shall be applied in strict accordance with the manufacturer's recommendations.

B. Interior, Exposed (e.g., central mechanical rooms, air handling unit rooms): Insulate with prefabricated, cellular glass pipe insulation (PI-1, I-1). Butter joints with joint sealant (JS-

CG1) and secure each section with not less than two wires (W-1). Finish with jacketing (JP-A1). Secure jacketing with straps. Finish elbows and fittings with mastic (FM-CG1), reinforced with fabric (FF-CG1); or finish with fitting covers (PFC-A1). Finish materials shall be applied in strict accordance with the manufacturer's recommendations.

C. Exterior, Protected: Same insulation system as for "Interior, Exposed" except thickness as required.

D. Exterior, Unprotected: Same insulation system as for "Exterior, Protected" except thickness as required.

E. Underground: Insulate with cellular glass pipe insulation (PI-1, I-1). Butter joints with joint sealant (JS-CG1) and secure each section with not less than two wires (W-1). Finish with underground jacket (JP-CG1) having 2-inch minimum overlap of the longitudinal seams. Heat seal longitudinal seams with a propane torch. Cover butt joints with a 4-inch wide strip of jacket with the edges heat sealed around the circumference. Precut the jacket to fit the contour or irregular surfaces such as 90° bends, 45° bends, fittings, etc. to which it is to be applied; in addition to heat sealing the jacket on these irregular surfaces, burn away the polyester film and glove a coat of mastic (FM-CG1) on the surface; while this coat is still tacky, embed a 10 x 10 asphalt impregnated fabric (FF-CG1) into the mastic. After this application has dried for not less than one hour, apply another coating of mastic. Caution: Keep mastic away from sparks and open flame and keep container closed when not in use.

F. Underground Expansion Joints, Expansion Elbows and Expansion Loops: Provide oversized insulation telescoped over the adjacent pipe insulation to provide close fit and adequate annular space to allow all movement expected to be encountered through maximum temperature ranges (including idle) of the conveyed fluid. Provide 1-1/2 pcf density fiberglass pipe insulation of thickness equal to the cellular glass insulation beneath the oversized insulation to completely fill the annular space void and yet allow freedom of pipe movement. Comply with insulation manufacturer's recommendations for these conditions or with details on drawings, as applicable.

3.4 DUCT SYSTEMS

A. General:

1. Locations and extent of both internal and external insulation for duct systems are described in section entitled "Ductwork" and/or by the "Duct Type and Location Schedule" on the Drawings.
2. Internal Insulation: Ductwork which is required to be insulated internally (acoustically/thermally lined) shall be insulated as work of the section entitled "Ductwork".
3. External Insulation: Ductwork which is required to be insulated externally shall be insulated as work of this section.
4. Factory Insulation: Ductwork which is factory manufactured with internal or external insulation is not to be additionally insulated as work of this section unless specifically stated. Such factory insulated ductwork generally consists of flexible externally insulated ductwork and double walled acoustically thermally lined ductwork.

B. Interior, Concealed (e.g., ceiling plenums): Where external insulation is required, insulate externally with 2.2 inch thick fiberglass blanket wrap (Type DI-1). Adhere duct insulation using adhesive (Type A-F1) applied in accordance with the manufacturer's recommendations. Where duct width exceeds twenty-four inches (24"), the insulation shall be additionally secured to the bottom of the duct using mechanical fasteners spaced one foot (1') on center. Insulation shall be applied with edges tightly butted, and all joints and breaks in the vapor

barrier sealed using glass fabric and mastic applied in conformance with manufacturer's recommendations.

C. Interior, Exposed, (e.g., air handling unit rooms): Where external insulation is required, insulate with 1-inch thick semi-rigid fiberglass board (Type DI-2). Adhere to ductwork with adhesive (Type A-F1). Finish joints and seams with finish fabric (Type FF-GP1).

3.5 DUCT SYSTEMS EQUIPMENT

A. General: Insulate as follows unless detailed to a greater extent on the Drawings.

B. Fire damper and Fire/Smoke Damper External Surfaces:

1. Externally Insulated Duct Locations: Extend duct insulation up face of fire damper to damper sleeve. Seal insulation edges with 4-inch minimum width duct tape.
2. Internally Insulated Duct Locations: Provide additional external insulation from a point on the duct 12 inches from the fire damper to the fire damper and on the face of the fire damper to the fire damper sleeve. Seal insulation edges with 4-inch minimum width duct tape.

C. Air Distribution Devices: Insulate the backs of all ceiling diffusers and other air outlet devices installed in other than return air plenums as specified for interior concealed ducts.

3.6 COLD EQUIPMENT AND RELATED COMPONENTS

A. Pump Volutes for Chilled Water Systems: Provide sealed insulated removable housing around pump volute for access for routine maintenance. Housing shall be finished with aluminum jacketing.

B. Expansion Tanks(s), Air Separator(s) and Chemical Pot Type Feeder(s) for Chilled Water Systems: Insulate with elastomeric sheet insulation (Type 1-3). Secure the insulation with adhesive (Type A-E1) applied to a clean surface and finish with a layer of membrane (Type FF-GP1) applied between two glove coats of mastic (Type M-GP1). Insulation thickness shall be one and one-half (1-1/2) inch.

C. Condensate Drain Piping From Cooling Equipment:

1. Interior, and Exterior, Protected: Insulate with preformed elastomeric pipe insulation (Type PI-5) secured with adhesive (Type A-E1) and finished with white finish coating (FCC-E1). Thickness 3/4-inch. Provide 25/50 flame/smoke rating.
2. Exterior, Unprotected: None applicable.

D. Cold Surfaces at Chillers and Evaporators: Factory insulated. No insulation required as work of this section.

E. Flexible Pipe Connectors for Vibration Isolation: Insulate with elastomeric insulation (Type 1-3). Secure the insulation with adhesive (Type A-E1) applied to a clean surface and finish with white finish coating (FC-E1). Insulation thickness shall be one and one-half inches (1-1/2").

END OF SECTION 23 07 00

SECTION 23 08 00
COMMISSIONING OF HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.3 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority.

C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.05 CxA'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.6 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, O&M manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing, adjusting, and balancing reports.

1.7 SUBMITTALS

A. Certificates of completion of installation, prestart, and startup activities.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 TESTING PREPARATION

A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 TEST AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.

1. The CxA will notify testing and balancing Contractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
2. The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3dB shall result in rejection of final testing. Variations in background noise must be considered.
4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of HVAC&R testing shall include entire HVAC&R installation, from each air handling unit, chiller, pumps, and heat exchanger through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the HVAC&R Subcontractor, testing and balancing Contractor, and HVAC&R Instrumentation and Control Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Heat Exchanger Testing and Acceptance Procedures: Testing shall be as required by manufacturer. Provide submittals, test data, inspector record, and heat exchanger certification to the CxA.

B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Section 23 09 23 and on plans "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the CxA with preparation of testing plans.

C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in 23 21 13 piping Sections. HVAC&R Subcontractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

D. Energy Supply System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of water quality, ethylene glycol, volume solution %, and equipment at

the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

E. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, refrigerant compressors and condensers, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

F. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

G. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and sound control.

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SECTION 23 09 23
INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Sensors and Transmitters:

1. Airflow stations
2. Flowmeters

B. Control Valves:

1. Control valves

C. Control Dampers:

1. Automated Dampers

1.3 PRODUCTS INTEGRATED WITH THE WORK OF THIS SECTION

A. Communications with Third Party Equipment:

1. Any additional integral control systems included with the products integrated with the work of this section shall be furnished with a BACnet or LonMark interface for integration into the Direct Digital Control System described in this section.

1.4 RELATED SECTIONS

A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents.

1.5 CONTROL SYSTEM GENERAL REQUIREMENTS

A. The control system shall be of the electronic microprocessor type employing Direct Digital Control (DDC) Open Protocol technology (LonMark and/or BACnet) technology for all control sequences unless specifically stated otherwise in the Sequence of Operation portion of this specification.

B. All DDC controllers shall be connected via a communications bus to an operators panel. The operators panel may be located on the face of one of the DDC controllers, or at an alternate location as approved by the Engineers. In addition, a portable operators panel may be connected to the system at any DDC controller location.

C. All DDC controllers shall be connected to a global information handler, which shall send and receive information of a global nature throughout the system. The information handler shall allow each DDC controller and operators panel access to all information contained within the system, regardless of location. The information handler shall also allow commands from any DDC controller or operators panel to be directed to any other DDC controller on either a global or individual basis. The information handler may be furnished as an integral part of one or more DDC controllers. This “Building Network Controller” shall be an Open protocol controller that will allow the simultaneous communication to BACnet and LonMark communication residing on the lower tier controllers (equipment controllers). The building controller shall be capable to be accessed using the majority of internet open protocols such as JAVA, XML, HTTP, etc.

D. Provisions shall be made to allow additional DDC controllers to be added at any point on the communications bus for future expansion.

E. Field Installed Devices (FID) shall be capable of stand-alone operation, as well as interfacing with the networked Building Control System. These controllers shall be LonMark and/or BACnet Protocols. No other protocols for this section will be acceptable.

F. Valve and damper operators shall be of the electronic type.

G. The Building Control System shall be made up of HVAC equipment with factory installed microprocessor-based Product Integrated Controls (PIC), distributed microprocessor-based Field Installed Devices (FID), input/output modules and necessary software.

H. The Product Integrated Controls (PIC) shall be factory installed controls capable of standalone operation. The controller shall be specifically designed to operate and monitor the functions of the HVAC equipment on which it is installed. The PIC shall be capable of interfacing onto the network.

I. The Building Network Controller shall incorporate the GUI (Graphical User Interface) via a standard web browser. Use of hardware keys or special licenses requirements to access the system with a browser is unacceptable. The Building controller will serve up the web pages on a standalone per building application for the intent that if the WAN is not working, an operator can access the system on site via the building internal network using an IP. A server computer will be located at the energy management office to supervise the remote panels and alarm if the communication is lost as well as any control function alarm. This server computer will also be the area of trending archives.

1.6 QUALITY ASSURANCE

A. All equipment or piping used in the conditioned air stream, spaces or return air plenum shall comply with NFPA 90A Flame/Smoke/Fuel contribution rating of 25/50/0 and all applicable local building codes or requirements.

B. All wiring shall conform to the National Electric Code (NEC).

C. Installation of the building Automation System shall be by the manufacturer of the controls or their local authorized agent who has a minimum of five (5) years of experience in the respective field.

D. BACnet systems shall conform to ASHRAE 135; LonWorks systems shall conform to the standards and protocols of the LonMark Interoperability Association.

E. All electrical components 25 V and above shall be UL listed or labeled.

1.7 CODES AND STANDARDS

A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:

1. National Electric Code (NEC)
2. Underwriters Laborites (UL)
3. Federal Communications Commission (FCC)

1.8 SYSTEM PERFORMANCE

A. Performance Standards: System shall conform to the following minimum standards over network connections.

B. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).

1. Graphic Display: A graphic with 20 dynamic points shall display with current data within 10 sec.
2. Graphic Refresh: A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.
3. Configuration and Tuning Screens: Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
4. Object Command: Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
5. Alarm Response Time: An object that goes into alarm shall be annunciated at the workstation within 15 sec.
6. Program Execution Frequency: Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
7. Performance: Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
8. Multiple Alarm Annunciation: Each workstation on the network shall receive alarms within 5 sec of other workstations.
9. Reporting Accuracy: System shall report values with minimum end-to-end accuracy listed in Table 1.
10. Control Stability and Accuracy: Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2.

Table 1
Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5ºC (±1ºF)
Ducted Air	±0.5ºC (±1ºF)
Outside Air	±1.0ºC (±2ºF)
Dew Point	±1.5ºC (±3ºF)
Water Temperature	±0.5ºC (±1ºF)
Delta-T	±0.15ºC (±0.25ºF)
Relative Humidity	±5% RH
Water Flow	±2% of full scale
Airflow (terminal)	±5% of full scale (see Note 1)
Airflow (measuring stations)	±1% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Air Pressure (space)	±3 Pa (±0.01 in. w.g.)
Water Pressure	±2% of full scale (see Note 2)
Electrical (A, V, W, Power Factor)	±1% of reading (see Note 3)
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO_2)	±50 ppm

Note 1: Accuracy applies to 10% - 100% of scale
Note 2: For both absolute and differential pressure
Note 3: Not including utility-supplied meters

Table 2
Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 in. w.g.) ±3 Pa (±0.01 in. w.g.)	0-1.5 kPa (0-6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	±10% of full scale	
Space Temperature	±1.0ºC (±2.0ºF)	
Duct Temperature	±1.5ºC (±3ºF)	
Humidity	±5% RH	
Fluid Pressure	±10 kPa (±1.5 psi) ±250 Pa (±1.0 in. w.g.)	MPa (1-150 psi) 0-12.5 kPa (0-50 in. w.g.) differential

1.9 SUBMITTALS

A. Product Submittal Requirements: Meet requirements of Division 01 on Shop Drawings, Product Data, and Samples. Provide six copies of shop drawings and other submittals on hardware, software, and equipment to be installed or furnished. Begin no work until submittals have been approved for conformity with design intent. Provide drawings as AutoCAD 2010 (or newer) compatible files on magnetic or optical disk (file format: .DWF and PDF) and 3 prints of each drawing on 11" x 17" paper. When manufacturer's cutsheets apply to a product series rather than a specific product, clearly indicate applicable data by highlighting or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cutsheets to fulfill submittal

requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Provide submittals within 12 weeks of contract award on the following:

1. Direct Digital Control System Hardware:

    a. Complete bill of materials indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
    b. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:

        i. Direct digital controllers (controller panels)
        ii. Transducers and transmitters
        iii. Sensors (include accuracy data)
        iv. Actuators
        v. Valves
        vi. Relays and switches
        vii. Control panels
        viii. Power supplies
        ix. Batteries
        x. Operator interface equipment
        xi. Wiring

    c. Wiring diagrams and layouts for each control panel. Show termination numbers.
    d. Floor plan schematic diagrams indicating field sensor and controller locations.
    e. Riser diagrams showing control network layout, communication protocol, and wire types.

2. Central System Hardware and Software:

    a. Complete bill of material indicating quantity, manufacturer, model number, and relevant technical data of equipment used.
    b. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:

        i. Central Processing Unit (CPU) or web server
        ii. Monitors
        iii. Keyboards
        iv. Power supplies
        v. Battery backups
        vi. Interface equipment between CPU or server and control panels
        vii. Operating System software
        viii. Operator interface software
        ix. Color graphic software
        x. Third-party software

    c. Schematic diagrams of control, communication, and power wiring for central system installation. Show interface wiring to control system.
    d. Network riser diagrams of wiring between central control unit and control panels.
    e. Submit proposed graphics for each equipment type for approval.
    f. Submit proposed trend log format for approval.
    g. All details for software on how to add / remove / create & modify graphics / configuring and reloading controls, etc.

3. Controlled Systems:

    a. Riser diagrams showing control network layout, communication protocol, and wire types.
    b. Schematic diagram of each controlled system. Label control points with point names. Graphically show locations of control elements.
    c. Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
    d. Instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
    e. Complete description of control system operation including sequences of operation. Include and reference schematic diagram of controlled system. List I/O points and software points specified in Section 23 09 93. Indicate alarmed and trended points.

4. Description of process, report formats, and checklists to be used in Section 23 09 23 Article 3.14 (Control System Demonstration and Acceptance).
5. BACnet Protocol Implementation Conformance Statement (PICS) for each submitted type of controller and operator interface.

B. Schedules:

1. Schedule of work provided within one month of contract award, indicating:

    a. Intended sequence of work items
    b. Start date of each work item
    c. Duration of each work item
    d. Planned delivery dates for ordered material and equipment and expected lead times
    e. Milestones indicating possible restraints on work by other trades or situations

2. Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.

C. Project Record Documents: Submit three copies of record (as-built) documents upon completion of installation for approval prior to final completion. Submittal shall consist of:

1. Project Record Drawings: As-built versions of submittal shop drawings provided as AutoCAD 2010 (or newer) compatible files on magnetic or optical disk (file format: .DWF and PDF) and 6 prints of each drawing on 11" x 17" paper.
2. Testing and Commissioning Reports and Checklists: Completed versions of reports, checklists, and trend logs used to meet requirements of Section 23 09 23 Article 3.14 (Control System Demonstration and Acceptance).
3. Operation and Maintenance (O&M) Manual: Printed, electronic, or online help documentation of the following:

    a. As-built versions of submittal product data.
    b. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
    c. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
    d. Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.

e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
f. Documentation of programs created using custom programming language including setpoints, tuning parameters, and object database. Electronic copies of programs shall meet this requirement if control logic, setpoints, tuning parameters, and objects can be viewed using furnished programming tools.
g. Graphic files, programs, and database on magnetic or optical media.
h. List of recommended spare parts with part numbers and suppliers.
i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
j. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation or web server software, and graphics software.
k. Licenses, guarantees, and warranty documents for equipment and systems.
l. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

D. Training Materials: Provide course outline and materials for each class at least six weeks before first class. Training shall be furnished via instructor-led sessions, computer-based training. Engineer will modify course outlines and materials if necessary to meet Owner's needs. Engineer will review and approve course outlines and materials at least three weeks before first class.

E. After the system has operated properly for 90 days following start-up of the final component of the HVAC and DDC systems, an as-built copy of the software shall be transmitted to the Owner for permanent record purposes.

1.10 WARRANTY

A. Warrant work as follows:

1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.
2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
3. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve Contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.

PART 2 - PRODUCTS

2.1 APPROVED CONTROL SYSTEMS

A. The following is the approved control system supplier and any substitution must be approved by the Architect, Engineer and Owner prior to bidding.

1. ABB
2. Siemens
3. Trane

B. The BCS shall be furnished, installed, and programmed by the control manufacturer or local authorized agent serving the St. Lucie County area. Control systems shall comply with the terms of this specification.

1. The Contractor shall use only operator workstation software, controller software, custom application programming language, and controllers from the corresponding manufacturer and product line unless Owner approves use of multiple manufacturers.
2. Other products specified herein (such as sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

2.2 MATERIALS

A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

2.3 COMMUNICATION

A. Communication:

1. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a network.
2. Install new wiring and network devices as required to provide a complete and workable control network.
3. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.

2.4 OPERATOR INTERFACE – **CENTRAL SERVER AND HARDWARE/TERMINAL NOT REQUIRED**

A. Operator Interface: Web server shall reside on high-speed network using Owner provided IP address with building controllers. Each standard browser connected to server shall be able to access all system information using user ID and password from any District computer.

B. Central Site: If the contractor does not already have a central server system in place, the contractor shall provide a central site system configuration that includes, as a minimum, the following components: Placement of computer/docking station to be determined by the Owner's Facilities Management.

1. Central Server Components:

    a. The central server shall consist of the following (minimum):

        i. System shall utilize a server class PC, tower or rack mounted
        ii. Two Xeon 2.8GHz, 1MB L3 cache processors
        iii. 2GB, DDR266 SDRAM memory
        iv. DVD+R/W or CD ROM
        v. Microsoft Windows Server 2003 (IIS 6.0) Or Server 2008, IIS V7 +
        vi. Microsoft SQL Server 2005
        vii. .NET Framework 1.1 BJE: .NET 3.5
        viii. Furnish all required serial, parallel, and network communication ports, and all cables for proper system operation. The server shall include a minimum 17", color monitor with 1024 x 768 screen resolution.

C. Hardware**:** Each workstation or web server shall consist of the following:

1. Hardware Base: Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times specified in Section 23 09 23 Paragraph 1.8. Hard disk shall have sufficient memory to store system software, one year of data for trended points specified, and a system database at least twice the size of the existing database at system acceptance. Configure computers and network connections if multiple computers are required to meet specified memory and performance. Web server or workstations shall be Dell or equal PCs with a minimum of:

    a. Intel i7 processor 3ghz
    b. 6 GB RAM
    c. 1 TB hard disk providing data at 100 MB/sec
    d. 24x CD-RW/DVD drive
    e. 24” LCD Monitor
    f. Windows 7 Ultimate 32 bit Operating System
    g. Serial, parallel, and network communication ports and cables required for proper system operation

D. Operator Functions: Operator interface shall allow each authorized operator to execute the following functions as a minimum:

1. Log In and Log Out: System shall require user name and password to log in to operator interface.
2. Point-and-click Navigation: Operator interface shall be graphically based and shall allow operators to access graphics for equipment and geographic areas using point-and-click navigation.
3. View and Adjust Equipment Properties: Operators shall be able to view controlled equipment status and to adjust operating parameters such as setpoints, PID gains, on and off controls, and sensor calibration.
4. View and Adjust Operating Schedules: Operators shall be able to view scheduled operating hours of each schedulable piece of equipment on a weekly or monthly calendar-based graphical schedule display, to select and adjust each schedule and time period, and to simultaneously schedule related equipment. System shall clearly show exception schedules and holidays on the schedule display.
5. View and Respond to Alarms: Operators shall be able to view a list of currently active system alarms, to acknowledge each alarm, and to clear (delete) unneeded alarms.
6. View and Configure Trends: Operators shall be able to view a trend graph of each trended point and to edit graph configuration to display a specific time period or data

range. Operator shall be able to create custom trend graphs to display on the same page data from multiple trended points.

7. View and Configure Reports: Operators shall be able to run preconfigured reports, to view report results, and to customize report configuration to show data of interest.
8. Manage Control System Hardware: Operators shall be able to view controller status, to restart (reboot) each controller, and to download new control software to each controller.
9. Manage Operator Access: Typically, only a few operators are authorized to manage operator access. Authorized operators shall be able to view a list of operators with system access and of functions they can perform while logged in. Operators shall be able to add operators, to delete operators, and to edit operator function authorization. Operator shall be able to authorize each operator function separately.
10. Create and modify control sequences.
11. Add or remove control points.

E. System Software:

1. Operating System: Web server shall have an industry-standard professional-grade operating system. Acceptable systems include Microsoft Windows.
2. Software shall be provided in these five categories:

    a. System executive software
    b. Software for user control over system configuration through the main controller via internet access (“Central site”), and by Maintenance Personnel in the field
    c. Facility monitoring functions
    d. Direct digital control
    e. Application software

3. Central site must be able to generate standard ASCII file formats to allow use with third-party software (e.g. Microsoft Excel) to generate and store owner-designed reports.
4. Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. It shall also provide a current status of all I/O points being controlled and applicable to each piece of equipment including analog readouts in appropriate engineering units at appropriate locations on the graphic representation. Programming, scheduling and set-point changes shall be accessible for modification on each menu for the associated equipment. Operator shall be able to automatically download changes from the central site to the appropriate program for the equipment being controlled. Operator shall be able to upload information from the field modules to the central site.
5. All operator commands shall be in graphics data base and menu driven. After the operator selects the desired object item or menu, the system shall display either the status of selected object item or the allowable options available. Upon entry of a command to the point or points desired as described above, the system shall, before performing any command requested and any entered data, ask the operator to verify his intent (e.g. “are you sure?”). System shall include error monitoring software for user's input error.
6. Output Format:

    a. The system shall operate on a System Format basis, regardless of the manner or hardware configuration in which the data is acquired. A "system" shall consist of a logical grouping of data points, related to a piece of mechanical equipment, an energy distribution system, or an architectural area. For example, in some cases, it may be desired to display, as a single system, a space temperature with its associated air handling unit, and in other cases to display all space temperatures on a floor or in a building. The DDC shall allow such determinations to be made without regard to the physical hardware locations of a point or group of points. Likewise, the

system shall accommodate future changes of system grouping and operations without field hardware changes.

b. All displays and logs shall contain a header line indicating date, day-of-week, and time.
c. All output displays or logs of a point or group of points shall contain, as a minimum, the following information:

    i. Graphic presentation of the System
    ii. User name of point
    iii. Point descriptor
    iv. Current value/status
    v. Associated engineering units
    vi. Alarm description

d. User names, point descriptors, and engineering units shall be operator definable on a per point basis.
e. Set points:

    i. All alarm colors shall be in red.
    ii. System shall be capable of utilizing the operator interface to change individual zone temperature setpoints.
    iii. System shall be capable of globally changing all or groups of set points.

f. Graphic Structure:

    i. Software graphics will ensure the operator is always aware of his position within the system as well as how to logically progress through the graphical hierarchy to select any desired graphic or other source of information.
    ii. System shall be programmed to provide a color graphic for:

        a) Each piece of equipment monitored or controlled
        b) Each floor and zone controlled - both HVAC and lighting.
        c) Each trend
        d) Each report

g. User Access Restriction. Operator sign-on shall require an assignable password. Access security shall have multiple levels, starting at ‘view only’ to full access, including ability to program. Designer shall coordinate with Owner’s representative for access to be included at each level. A typical progression would include: readout only, local room set point; local schedule; system set points; system schedules; building set points, schedules, and sequences; campus set points, schedules, and sequences; district set points, schedules, and sequences.
h. Power Failure/Automatic Restart:

    i. Power failures shall cause the system to go into an orderly shutdown with no loss of program memory.
    ii. Upon resumption of power, the system shall automatically restart and record the times and dates of the power failure and restoration at the Central Site.
    iii. “Restart” program shall automatically restart affected field equipment. Operator shall be able to define an automatic power up time delay for each piece of equipment under control.

7. User Control Over System Configuration:

    a. Database Creation and Modification. All changes shall be done utilizing standard procedures and be capable of being done while the system is on-line and operational. The system shall allow changes to be made through the portable operator terminal and from the central site. To aid the user, instructive prompting software shall be provided.
    b. System shall permit the operator, with proper password, to perform as a minimum the following:

        i. Add and delete points
        ii. Modify point parameters
        iii. Create and modify control sequences
        iv. Reconfigure application programs
        v. Add and/or modify graphics

    c. All data points within the database shall be completely accessible as independent or dependent variables for custom programming, calculation, interlocking, or manipulation.
    d. Graphics software shall be fully implemented and operational to accomplish the following:

        i. Create a new graphic picture
        ii. Modify a portion of a graphic picture
        iii. Delete a graphic picture, or any portion thereof
        iv. Call up a graphic picture
        v. Cancel the display of a graphic picture
        vi. Assign conditions which automatically initiate the display
        vii. Overlay alphanumeric and graphics
        viii. Save the graphic picture
        ix. Display latest process data fully integrated with the graphic display

8. Facility Management Functions:

    a. Trend Logging:

        i. System shall be able to trend and display either numerically or graphically any analog or digital points in the system.
        ii. System shall be able to simultaneously, graphically display any two trended points within a module function block or any point in the module with respect to the outside air temperature, enthalpy, or relative humidity.
        iii. Each field module shall be capable of storing the most recent 60 samples for each single trend point or the most recent 30 samples for each of two trended points from one module function block.
        iv. Each module shall be capable of automatically uploading on a daily basis all accumulated trend data to the central site for permanent storage on non-volatile memory.

    b. Run Time:

        i. System shall provide run time information for all digital output and input points on command from the operator. Maximum run time limits shall be operator definable and shall be capable of automatically issuing an alert when the run time maximum is exceeded. Operator shall be able to reset the run time accumulator.

ii. Run time hours and start time date shall be retained in non-volatile module memory.
iii. Each module shall be capable of automatically uploading all accumulated data to the central site for permanent storage on non-volatile memory.

c. Alarm Conditions and Maintenance Messages:

i. Central site shall allow receipt of alarms and messages while in a functional mode other than energy management. i.e., Incoming alarms shall be displayed, and generate an audible alarm when deemed appropriate by the operator, while the operator is using other functions of the system. The operator shall be able to return to his prior operation after the alarm is received and acknowledged.
ii. System shall distinguish between alarms and messages with alarms having a higher priority.
iii. System shall be capable of delivering an alarm or message directly to up to three different remote locations, in addition to the central site, through E-Mail, E-Page, alphanumeric page, or other appropriate method. Operator shall determine if alarms or messages are to be based on temperature limit, status, off-normal reporting, or other condition. Coordinate with Owner to determine what alarm condition(s) merit direct delivery of alarm messages. Typically, any condition, or set of conditions, that would cause the plant to shut down or have the potential to damage equipment or injure personnel would merit such direct reporting.
iv. System shall be capable of generating maintenance messages when run time accumulation maximum limits are exceeded.
v. Text for operator alarm and messages shall be operator definable. System shall be capable of storing at least 100 messages each of any length. Generic messages used for multiple points throughout the system shall only count as one message. In the event the central site is powered down, alarms shall be stored in the modules until the central site is restored.
vi. Central site shall be capable of transferring all alarms to non-volatile memory for storage.

d. Reports and Archiving:

i. Field modules shall be capable of calling the central site to automatically upload all current and accumulated data. This shall be delivered to the central site for permanent storage on non-volatile memory. All reports and stored data shall be transferable to other sites or media.
ii. System shall be capable of reporting and archiving the following information as a minimum:

a) Outside air temperature history and degree day history
b) Electric demand and usage history
c) All trended points
d) All alarms and messages
e) Equipment runtime information

iii. The system shall also provide the following additional reports for which archiving is not applicable:

a) All points summary
b) Building operating schedules
c) Printout of any graphic screen

iv. All systems reports shall be capable to being viewed via the central site and printed at the operator's discretion

9. Direct Digital Control Software:

a. System shall continuously perform DDC functions at the local DDC controller in a stand-alone mode. The operator shall be able to design and modify the control loops to meet the requirements of the system being operated. Operators shall use system provided displays for tuning of PID loops. These displays shall include the past three input variable values, the set point for the loop as well as the sample interval and the results of the proportional, integral and derivative effects of the final output.
b. Each Controller shall perform the following functions:

i. Identify and report alarm conditions
ii. Execute DDC algorithms
iii. Execute all application programs indicated on the I/O Summary table
iv. Trend and store data

c. In the event of a Controller failure, all points under its control shall be commanded to the failure mode.
d. All DDC software shall reside in the respective DDC controller.

10. Application Software:

a. Application software shall be as required to produce and implement the sequences of operation.

F. Portable Operator's Terminal – **NOT PROVIDED**

1. Provide all necessary software to configure a Dell or equal laptop computer for use as a Portable Operator's Terminal. Operator shall be able to connect configured Terminal to the system network or directly to each controller for programming, setting up, and troubleshooting.

a. Minimum Requirements:

i. Dell XT Tablet PC
ii. 12.1” Touch screen
iii. 2 GB RAM
iv. 64GB SSD Harddrive
v. Intel WiFi Link 5300 (802.11a/g/n 3x3)
vi. Bluetooth Module
vii. 6-cell 42W/Hr Li-ion primary battery
viii. Spare 6-cell battery
ix. Windows 7 Ultimate 32 bit operating system

2.5 CONTROLLER SOFTWARE

A. Building and energy management application software shall reside and operate in system controllers. Applications shall be editable through operator workstation, web browser interface, or engineering workstation.

B. Scheduling: See Paragraph 2.4.C.4 (View and Adjust Operating Schedules). System shall provide the following schedule options as a minimum:

1. Weekly: Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).
2. Exception: Operator shall be able to designate an exception schedule for each of the next 365 days. After an exception schedule has executed, system shall discard and replace exception schedule with standard schedule for that day of the week.
3. Holiday: Operator shall be able to define 24 special or holiday schedules of varying length on a scheduling calendar that repeats each year.

C. System Coordination: Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.

D. Remote Communication: System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.

E. Maintenance Management: System shall generate maintenance alarms when equipment exceeds adjustable runtime, equipment starts, or performance limits. Configure and enable maintenance alarms as recommended by manufacturer for following equipment:

1. Chillers

F. Sequencing: Application software shall sequence chillers and pumps as specified in control sequences.

G. PID Control: System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of outputs.

H. Staggered Start: System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.

I. Energy Calculations:

1. System shall accumulate and convert instantaneous power (kW) or flow rates (L/s [gpm]) to energy usage data.
2. System shall calculate a sliding-window average (rolling average). Operator shall be able to adjust window interval to 15 minutes, 30 minutes, or 60 minutes.
3. System shall communicate with all electrical sub metering equipment and gather data on the sub system electrical consumption characteristics (i.e. lighting, mechanical equipment, etc.).

J. Anti-Short Cycling: Binary output objects shall be protected from short cycling by means of adjustable minimum on-time and off-time settings.

K. On and Off Control with Differential: System shall provide direct- and reverse-acting on and off algorithms with adjustable differential to cycle a binary output based on a controlled variable and setpoint.

L. Runtime Totalization: System shall provide an algorithm that can totalize runtime for each binary input and output. Operator shall be able to enable runtime alarm based on exceeded adjustable runtime limit. Configure and enable runtime totalization and alarms as specified in Sequence of Operation.

M. Software required to provide the initial operation routines shall not consume more than 70% of programmable capability of the controller.

2.6 CONTROLLERS

A. General: Provide Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as required to achieve performance specified in Section 23 09 23 Article 1.8 (System Performance). Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet or LonMark Device profile.

B. The main, or central, controller shall have non-volatile memory for all system sequences, setpoints, trended data, etc., for proper system operation, to support restart upon power loss, and to prevent loss of historical data. The main, or central, controller shall have a human interface device mounted on the front surface of its panel for data read-out and control input.

C. Communication:

1. Service Port: Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on drawings.
2. Signal Management: BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.
3. Data Sharing: Each BC and AAC shall share data as required with each networked BC and AAC.
4. Stand-Alone Operation: Each piece of equipment specified shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network. At a minimum, provide control for each:

    a. AHU.
    b. FCU.
    c. VAV.

D. Environment: Controller hardware shall be suitable for anticipated ambient conditions.

1. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).
2. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).

E. Real-Time Clock: Controllers that perform scheduling shall have a real-time clock.

F. Serviceability:

1. Controllers shall have diagnostic LEDs for power, communication, and processor.

2. Wires shall be connected to a field-removable modular terminal strip or to a termination card connected by a ribbon cable.
3. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

G. Memory:

1. Controller memory shall support operating system, database, and programming requirements.
2. Each BC and AAC shall retain BIOS and application programming for at least 72 hours in the event of power loss.
3. Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.

H. Immunity to Power and Noise: Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

I. Transformer: ASC power supply shall be fused or current limiting and shall be rated at a minimum of 125% of ASC power consumption.

J. All control panels shall have wiring diagrams for the devices contained within. Wiring within the panel should be labeled for the device to which it goes from the controller (valve, damper, etc.).

2.7 INPUT AND OUTPUT INTERFACE

A. General: Hard-wire input and output points to BCs, AACs, ASCs, or SAs.

B. Protection: Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.

C. Binary Inputs: Binary inputs shall monitor the on and off signal from a remote device. Binary inputs shall provide a wetting current of at least 12 mA and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.

D. Pulse Accumulation Inputs: Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 10 pulses per second.

E. Analog Inputs: Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.

F. Binary Outputs: Binary outputs shall send an on-or-off signal for on and off control. Building Controller binary outputs shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.

G. Analog Outputs: Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.

H. Tri-State Outputs: Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.

I. Universal Inputs and Outputs: Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

2.8 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies: Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.

a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
b. Line voltage units shall be UL recognized and CSA listed.

B. Power Line Filtering:

1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:

a. Dielectric strength of 1000 V minimum
b. Response time of 10 nanoseconds or less
c. Transverse mode noise attenuation of 65 dB or greater
d. Common mode noise attenuation of 150 dB or greater at 40-100 Hz

2.9 AUXILIARY CONTROL DEVICES

A. Motorized Control Dampers:

1. Type: Control dampers shall have linear flow characteristics and shall be parallel- or opposed-blade type as specified below or as scheduled on drawings.

a. Outdoor and return air mixing dampers and face-and-bypass dampers shall be parallel-blade and shall direct airstreams toward each other.
b. Other modulating dampers shall be opposed-blade.

c. Two-position shutoff dampers shall be parallel- or opposed-blade with blade and side seals.

2. Frame: Damper frames shall be 2.38 mm (13 gauge) galvanized steel channel or 3.175 mm (1/8 in.) extruded aluminum with reinforced corner bracing.
3. Blades: Damper blades shall not exceed 20 cm (8 in.) in width or 125 cm (48 in.) in length. Blades shall be suitable for medium velocity (10 m/s [2000 fpm]) performance. Blades shall be not less than 1.5875 mm (16 gauge).
4. Shaft Bearings: Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze, or better.
5. Seals: Blade edges and frame top and bottom shall have replaceable seals of butyl rubber or neoprene. Side seals shall be spring-loaded stainless steel. Blade seals shall leak no more than 50 L/s·m^2 (10 cfm per ft^2) at 1000 Pa (4 in. w.g.) differential pressure. Blades shall be airfoil type suitable for wide-open face velocity of 7.5 m/s (1500 fpm).
6. Acceptable manufacturer is Ruskin CD – 50, or approved equal.

B. Electric Damper and Valve Actuators:

1. Stall Protection: Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation.
2. Spring-return Mechanism: Actuators used for power-failure and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS).
3. Signal and Range: Proportional actuators shall accept a 0-10 Vdc or a 0-20 mA control signal and shall have a 2-10 Vdc or 4-20 mA operating range.
4. Wiring: 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring.
5. Manual Positioning: Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 7 N·m (60 in.-lb) torque capacity shall have a manual crank.
6. All actuators are to provide position feedback to system.
7. Acceptable manufactures Belimo, or approved equal.

C. Control Valves:

1. General: Select body and trim materials in accordance with manufacturer's recommendations for design conditions and service shown.
2. Type: Provide two- or three-way control valves for two-position or modulating service as shown.
3. Water Valves:

a. Valves providing two-position service shall be quick opening. Two-way valves shall have replaceable disc or ball.
b. Close-off (Differential) Pressure Rating: Valve actuator and trim shall provide the following minimum close-off pressure ratings.

i. Two-way: 150% of total system (pump) head.
ii. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.

c. Ports: Valves providing modulating service shall be pressure independent characterized control.
d. Sizing:

i. Two-position service: line size.

ii. Two-way modulating service: select pressure drop equal to the greatest of twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 35 kPa (5 psi).
iii. Three-way modulating service: select pressure drop equal to the smaller of twice the pressure drop through the coil exchanger (load) or 35 kPa (5 psi).

e. Fail Position: Water valves shall fail normally open or closed as follows unless otherwise specified.

i. Water zone valves: normally open.
ii. Heating coils in air handlers: normally open.
iii. Chilled water control valves: normally closed.
iv. Other applications: as scheduled or as required by sequences of operation.

4. Acceptable manufactures Belimo Energy Valve.

D. Butterfly Valves – High Performance:

1. Valve body shall be full lugged carbon steel ANSI Class 150 [300] body with a 316 stainless steel disc without a nylon coating, RTFE seat, and be ANSI Class 150300 flange standards. Blowout-proof shaft shall be 17-4ph stainless steel and shall be supported at four locations by glass-backed TFE bushings. Valve packing shall be Chevron TFE and shall include fully adjustable packing flange and separable packing gland. Valve body shall have long stem design to allow for 2" insulation (minimum). Valve face-to-face dimensions shall comply with API 609 and MSS-SP-68. Valve assembly shall be completely assembled and tested, ready for installation
2. Industrial Actuators *(ONLY TO BE USED WITH 2.16.I Butterfly Valves)*
3. Manufactured, brand labeled or distributed by BELIMO
4. The combination of valve and actuator shall meet the close-off requirements as specified
5. Coupling: ISO 5211 mounting standards
6. Overload Protection: A self resetting thermal switch embedded in the motor
7. Manual Override: Actuator shall be equipped with a hand wheel or shaft for manual override to permit operation of the actuator in the event of an electrical power failure
8. Power Requirements: 24VAC control power.
9. Auxiliary Switches: 2 SPDT rated 3A at 250 VAC
10. Temperature Rating: -22 to +150ºF -30 to +65ºC.
11. Housing: Minimum requirement NEMA type 4X/ IP67 with an industrial quality coating. Actuator shall have an internal heater to prevent condensation within the housing. A visual indication beacon shall indicate position status of the device
12. Agency Listing: ISO, CE, CSA
13. The manufacturer shall warrant for 2 years from the date of production

E. Low-Voltage Space Thermostats: Low-voltage space thermostats shall be 24 V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C-30°C (55°F-85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.

1. Line-Voltage Space Thermostats: Line-voltage space thermostats shall be bimetal-actuated, open-contact type or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listing for electrical rating, concealed setpoint adjustment, 13°C-30°C (55°F-85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.
2. Low-Limit Thermostats: Low-limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 6 m (20 ft) long. Element shall sense

temperature in each 30 cm (1 ft) section and shall respond to lowest sensed temperature. Low-limit thermostat shall be manual reset only.

F. Temperature Sensors:

1. Type: Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.
2. Duct Sensors: Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5 m (5 ft) in length per 1 m^2(10 ft^2) of duct cross-section.
3. Immersion Sensors: Provide immersion sensors with a separable stainless steel well. Well pressure rating shall be consistent with system pressure it will be immersed in. Well shall withstand pipe design flow velocities.
4. Space Sensors:

    a. Space sensors shall have no display.
    b. Space sensors shall have setpoint adjustment, override switch and communication port.

5. Differential Sensors: Provide matched sensors for differential temperature measurement.

G. Humidity Sensors:

1. Duct and room sensors shall have a sensing range of 20%-80%.
2. Duct sensors shall have a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20%-95% RH and shall be suitable for ambient conditions of 40°C-75°C (40°F-170°F).
4. Humidity sensors shall not drift more than 1% of full scale annually.
5. Room Humidity sensors shall be integral to the room temperature sensor so that there is only one sensor per room.

H. Air Flow Monitor Stations:

1. Furnish and coordinate the installation of Air Flow Measuring Stations according to the Contract Documents.
2. Include manufacturer's recommended number of probes for the proper traverse of the air duct, and required mounting hardware.
3. Provide all cabling required for connection to probe assemblies and transmitter electronics.
4. Where these stations serve as primary signals for airflow control loops, verify location and installation to assure that accurate primary signals are obtained.
5. Acceptable manufacturer is Ebtron (Gold Series).

I. Flow Switches: Flow-proving switches shall be paddle (water service only) or differential pressure type (air or water service) as shown. Switches shall be UL listed, SPDT snap-acting, and pilot duty rated (125 VA minimum).

1. Paddle switches shall have adjustable sensitivity and NEMA 1 enclosure unless otherwise specified.
2. Differential pressure switches shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

J. Relays:

1. Control Relays: Control relays shall be plug-in type, UL listed, and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
2. Time Delay Relays: Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable ±100% from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

K. Override Timers:

1. Unless implemented in control software, override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration required by application. Provide 0-6 hour calibrated dial unless otherwise specified. Flush mount timer on local control panel face or where shown.

L. Current Transmitters:

1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4-20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
3. Unit shall be split-core type for clamp-on installation on existing wiring.

M. Current Transformers:

1. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
2. Transformers shall be available in various current ratios and shall be selected for ±1% accuracy at 5 A full-scale output.
3. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

N. Voltage Transmitters:

1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4-20 mA output with zero and span adjustment.
2. Adjustable full-scale unit ranges shall be 100-130 Vac, 200-250 Vac, 250-330 Vac, and 400-600 Vac. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.

O. Voltage Transformers:

1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
2. Transformers shall be suitable for ambient temperatures of 4°C-55°C (40°F-130°F) and shall provide ±0.5% accuracy at 24 Vac and 5 VA load.
3. Windings (except for terminals) shall be completely enclosed with metal or plastic.

P. Power Monitors:

1. Power monitors shall be three-phase type and shall have three-phase disconnect and shorting switch assembly, UL listed voltage transformers, and UL listed split-core current transformers.
2. Power monitors shall provide selectable output: rate pulse for kWh reading or 4-20 mA for kW reading. Power monitors shall operate with 5 A current inputs and maximum error of ±2% at 1.0 power factor or ±2.5% at 0.5 power factor.

Q. Current Switches:

1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

R. Pressure Transducers:

1. Transducers shall have linear output signal and field-adjustable zero and span.
2. Continuous operating conditions of positive or negative pressure 50% greater than calibrated span shall not damage transducer sensing elements.
3. Water pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Transducer shall have 4-20 mA output, suitable mounting provisions, and block and bleed valves.
4. Water differential pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Over-range limit (differential pressure) and maximum static pressure shall be 2000 kPa (300 psi.) Transducer shall have 4-20 mA output, suitable mounting provisions, and 5-valve manifold.

S. Differential Pressure Switches: Differential pressure switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum) and shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

T. Flow Meter / BTU Meter:

1. Provide insertion electromagnetic type flow meters.

    a. Minimum pressure: 150 psig
    b. Minimum temperature rating: 250 deg F
    c. Stainless steel probe of length to span inside of pipe.
    d. Equal to Onicon F-3500

U. BTU Meter:

1. Where BTU meters are called out, provide companion BTU meter system along with flow meter equal to Onicon F-3500 flow meter with System 10 BTU meter or approved equal.

    a. Temp reading accuracy: +/- 15 deg F over calibrated range.
    b. Temp reading range: 32 deg F to 200 deg F.

V. Pressure-Electric (PE) Switches: PE switches shall be UL listed, pilot duty rated (125 VA minimum) or motor control rated, metal or neoprene diaphragm actuated, operating pressure rated for 0-175 kPa (0-25 psig), with calibrated scale minimum setpoint range of 14-125 kPa (2-18 psig).

1. Provide one- or two-stage switch action (SPDT, DPST, or DPDT) as required by application.
2. Switches shall be open type (panel-mounted). Exception: Switches shall be enclosed type for remote installation. Enclosed type shall be NEMA 1 unless otherwise specified.
3. Each pneumatic signal line to PE switches shall have permanent indicating gauge.

W. Local Control Panels:

1. Indoor control panels shall be fully enclosed NEMA 1 construction with hinged door key-lock latch and removable sub-panels. A common key shall open each control panel and sub-panel.
2. Prewire internal and face-mounted device connections with color-coded stranded conductors tie-wrapped or neatly installed in plastic troughs. Field connection terminals shall be UL listed for 600 V service, individually identified per control and interlock drawings, with adequate clearance for field wiring.
3. Each local panel shall have a control power source power switch (on-off) with overcurrent protection.

2.10 WIRING AND RACEWAYS

A. General: Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.

B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Architect or Engineer for resolution before starting rough-in work.

B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.

C. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Engineer and obtain written instructions for changes necessary to accommodate Section 23 09 23 work with work of others. Controls Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

3.2 PROTECTION

A. Controls Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.

B. Controls Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 COORDINATION

A. Site:

1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.
2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Submittals: See Section 23 09 23 Article 1.9 (Submittals).

C. Test and Balance:

1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.
2. Train Test and Balance Contractor to use control system interface tools.
3. Provide a qualified technician to assist with testing and balancing the first 20 terminal units.
4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.

D. Life Safety:

1. Duct smoke detectors required for air handler shutdown are provided under Division 28. Interlock smoke detectors to air handlers for shutdown as specified in Sequence of Operation.

E. Coordination with Other Controls: Integrate with and coordinate controls and control devices furnished or installed by others as follows.

1. Communication media and equipment shall be provided as specified in Section 23 09 23 Article 2.3 (Communication).
2. Each supplier of a controls product shall configure, program, start up, and test that product to meet the sequences of operation regardless of where within the contract documents those products are described.
3. Coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
4. Controls Contractor shall be responsible for integration of control products provided by multiple suppliers regardless of where integration is described within the contract documents.

3.4 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.

B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.

C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.

D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.

E. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.

3.5 FIELD QUALITY CONTROL

A. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Section 23 09 23 Article 1.7 (Codes and Standards).

B. Continually monitor field installation for code compliance and workmanship quality.

C. Contractor shall arrange for work inspection by local or state authorities having jurisdiction over the work.

3.6 WIRING

A. Control and interlock wiring and installation shall comply with national and local electrical codes, Division 26, and manufacturer's recommendations. Where the requirements of Section 23 09 23 differ from Division 26, Section 23 09 23 shall take precedence.

B. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC and Division 26.

C. Low-voltage wiring shall meet NEC Class 2 requirements. Subfuse low-voltage power circuits as required to meet Class 2 current limit.

D. NEC Class 2 (current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application.

E. Install wiring in raceway where subject to mechanical damage and at levels below 3 m (10ft) in mechanical, electrical, or service rooms.

F. Install Class 1 and Class 2 wiring in separate raceways. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.

G. Do not install wiring in raceway containing tubing.

H. Run exposed Class 2 wiring parallel to a surface or perpendicular to it and tie neatly at 3 m (10 ft) intervals.

I. Use structural members to support or anchor plenum cables without raceway. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.

J. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes shall not be hung on or attached to ductwork, electrical raceways, piping, or ceiling suspension systems.

K. Size raceway and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.

L. Include one pull string in each raceway 2.5 cm (1 in.) or larger.

M. Use color-coded conductors throughout.

N. Locate control and status relays in designated enclosures only. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.

O. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 15 cm (6 in.) between raceway and high-temperature equipment such as steam pipes or flues.

P. Adhere to requirements in Division 26 where raceway crosses building expansion joints.

Q. Install insulated bushings on raceway ends and enclosure openings. Seal top ends of vertical raceways.

R. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.

S. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Do not use flexible metal raceway less than ½ in. electrical trade size. Use liquid-tight flexible metal raceways in areas exposed to moisture including chiller and boiler rooms.

T. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join raceway sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations not in boxes with bushings.

3.7 COMMUNICATION WIRING

A. Communication wiring shall be low-voltage Class 2 wiring and shall comply with Article 3.6 (Wiring).

B. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.

C. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.

D. Verify entire network's integrity following cable installation using appropriate tests for each cable.

E. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.

F. Each run of communication wiring shall be a continuous length without splices when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible using commercially available lengths.

G. Label communication wiring to indicate origination and destination.

H. Ground coaxial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.8 FIBER OPTIC CABLE

A. During installation do not exceed maximum pulling tensions specified by cable manufacturer. Post-installation residual cable tension shall be within cable manufacturer's specifications.

B. Install cabling and associated components according to manufacturers' instructions. Do not exceed minimum cable and unjacketed fiber bend radii specified by cable manufacturer.

3.9 INSTALLATION OF SENSORS

A. Install sensors according to manufacturer's recommendations.

B. Mount sensors rigidly and adequately for operating environment.

C. Install room temperature sensors on concealed junction boxes properly supported by wall framing.

D. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.

E. Use averaging sensors in mixing plenums and hot and cold decks. Install averaging sensors in a serpentine manner vertically across duct. Support each bend with a capillary clip.

F. Install mixing plenum low-limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m^2 (1 ft^2) of coil area.

G. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

H. Install outdoor air temperature sensors on north wall at designated location with sun shield.

I. Differential Air Static Pressure:

1. Supply Duct Static Pressure: Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.
2. Return Duct Static Pressure: Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.
3. Building Static Pressure: Pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe high-pressure port to a location behind a thermostat cover.
4. Piping to pressure transducer pressure ports shall contain a capped test port adjacent to transducer.

5. Pressure transducers, except those controlling VAV boxes, shall be located in control panels, not on monitored equipment or on ductwork. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.
6. Mount gauge tees adjacent to air and water differential pressure taps. Install shut-off valves before tee for water gauges.

J. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

3.10 FLOW SWITCH INSTALLATION

A. Use correct paddle for pipe diameter.

B. Adjust flow switch according to manufacturer's instructions.

3.11 ACTUATORS

A. General: Mount actuators and adapters according to manufacturer's recommendations.

B. Electric and Electronic Damper Actuators: Mount actuators directly on damper shaft or jackshaft unless shown as a linkage installation. Link actuators according to manufacturer's recommendations.

1. For low-leakage dampers with seals, mount actuator with a minimum 5° travel available for damper seal tightening.
2. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, then tighten linkage.
3. Check operation of damper-actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
4. Provide necessary mounting hardware and linkages for actuator installation.

C. Valve Actuators: Connect actuators to valves with adapters approved by actuator manufacturer.

3.12 PROGRAMMING

A. Point Naming: Name points as shown on the equipment points list provided with each sequence of operation. Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number. For example, "Zone Temp 1" for Zone 1, "Zone Temp 2" for Zone 2.

B. Software Programming: Programming shall provide actions for each possible situation. Graphic- or parameter-based programs shall be documented. Text-based programs shall be modular, structured, and commented to clearly describe each section of the program.

1. Application Programming: Provide application programming that adheres to sequences of operation specified. Program documentation or comment statements shall reflect language used in sequences of operation.

2. System Programming: Provide system programming necessary for system operation.

C. Operator Interface:

1. Standard Graphics: Provide graphics as specified. Show on each equipment graphic input and output points and relevant calculated points such as indicated on the applicable Points List in and sequences shown on the plans. Point information on graphics shall dynamically update.
2. Install, initialize, start up, and troubleshoot operator interface software and functions (including operating system software, operator interface database, and third-party software installation and integration required for successful operator interface operation).

3.13 CONTROL SYSTEM CHECKOUT AND TESTING

A. Startup Testing: Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any or all startup testing.

1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished under Section 23 09 23.
2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.
3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
5. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.
6. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.
7. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.
8. Alarms and Interlocks:

a. Check each alarm with an appropriate signal at a value that will trip the alarm.
b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

3.14 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration: Prior to acceptance, perform the following performance tests to demonstrate system operation and compliance with specification after and in addition to tests specified in Article 3.13 (Control System Checkout and Testing). Provide Engineer with log documenting completion of startup tests.

1. Owner/Engineer may be present to observe and review system demonstration. Notify Owner/Engineer at least 10 days before system demonstration begins.
2. Demonstration shall follow process submitted and approved under Section 23 09 23 Article 1.9 (Submittals). Complete approved checklists and forms for each system as part of system demonstration.
3. Demonstrate actual field operation of each sequence of operation as specified in Section 23 09 93. Provide at least two persons equipped with two-way communication. Demonstrate calibration and response of any input and output points requested by Engineer. Provide and operate test equipment required to prove proper system operation.
4. Demonstrate compliance with Section 23 09 23 Part 1 (System Performance).
5. Demonstrate compliance with sequences of operation through each operational mode.
6. Demonstrate complete operation of operator interface.
7. Demonstrate each of the following:

    a. DDC loop response: Supply graphical trend data output showing each DDC loop's response to a setpoint change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show setpoint, actuator position, and controlled variable values. Engineer will require further tuning of each loop that displays unreasonably under- or over-damped control.
    b. Demand limiting: Supply trend data output showing demand-limiting algorithm action. Trend data shall document action sampled each minute over at least a 30-minute period and shall show building kW, demand-limiting setpoint, and status of setpoints and other affected equipment parameters.
    c. Building fire alarm system interface.
    d. Trend logs for each system: Trend data shall indicate setpoints, operating points, valve positions, and other data as specified in the points list provided with each sequence of operation. Each log shall cover three 48-hour periods and shall have a sample frequency not less than 10 minutes or as specified on its points list. Logs shall be accessible through system's operator interface and shall be retrievable for use in other software programs as specified in.
    e. Minimum Trend Log Requirements:

        i. Control Stability Trend Logs:

            a) Each digital or analog output to valves, dampers, adjustable frequency drives and other control devices shall be included.
            b) Scan time shall be at five second intervals for a duration of ten minutes.
            c) Start of the sets shall be immediately after change from one mode to another, i.e., unoccupied to occupied, no economizer to economizer, off to on, etc. Only one log will be required for each output as long as it addresses all controlled elements.
            d) Where control of a piece of equipment is by factory furnished packaged controls, then the controlled temperature which is monitored shall be included. For instance, where a chiller is controlled by its own control system and control is from leaving chilled water temperature, then leaving chilled water temperature shall be included in the log set.

        ii. System Operation Trend Logs:

            a) Each measured value (temperature, pressure, amps, etc.), equipment status (on-off, percent speed or position, etc.), each mode (unoccupied, cool-down, occupied, etc.), each setpoint and each alarm shall be included.
            b) Scan time shall be at operation adjustable intervals with a duration of 24 hours.

c) Sets shall be included for cooling only, cooling plus economizer and heating only. Where start up occurs at a defined season and both heating and cooling cannot be logged, then the system will be accepted subject to a final demonstration of the other season, when weather permits.

iii. Load Profile Trend Log Sets:

a) The total campus load in tons shall be calculated using flow and temperature difference between supply and return water.
b) Chiller plant load shall be calculated using chiller flow and temperature difference between supply and return water.
c) Heat rejection load on water cooled equipment shall be calculated based on condenser water flow and temperature difference between supply and return water.
d) Compressor power input (KWH) shall be calculated based on measured KW or volts and amps and a look-up table provided by the compressor supplier. This shall be logged and converted to tons (KW x 3414 divided by 12,000) and compared to the compressor tons obtained by subtracting chiller tons from condenser tons.
e) Tonnage shall be calculated by averaging six instantaneous readings per hour taken at ten minute intervals. Tonnage for each of the 24 hours shall be listed.

iv. Energy Use Trend Log Sets:

a) Energy use (KWH) of each chiller compressor shall be calculated using KWH or measured volts, amps and a look-up table provided by the manufacturer.
b) Energy use of each dedicated primary chilled water pump, condenser water pump and cooling tower fan shall be calculated using measured KWH or volts and amps prorated to motor nameplate data to convert to KW. Chiller auxiliary power use (KWH) shall be added to the chiller power use to get each individual chiller system power use.
c) Energy use of the secondary chilled water distribution pumps shall be obtained in a similar manner and added to the chiller system energy use to get central plant total energy use. This shall be compared to the measured central plant KWH where available.
d) Energy use of each fan shall be calculated using measured amps and a look-up table provided by the motor manufacturer to convert to KW.
e) Energy use of constant flow exhaust fans, small pumps, etc. shall be estimated based on input data of KW taken from the test and balance data and added based on fan on or off status.
f) The sum of all HVAC power use shall be totaled and listed.
g) KWH shall be calculated by averaging six instantaneous KW readings per hour taken at the same ten-minute intervals as the load measurements. Each chiller, central plant and total building energy use shall be converted to KW/ton and listed.
h) Energy consumption of the entire building shall be taken from the power company meters and listed.
i) Outdoor air wetbulb shall be listed.
j) Data shall be presented for each of the 24 hours each day.
k) Energy use shall be presented in bar graph form.

v. Custom Trend Log Sets:

a) The operator shall have the ability to customize all trend logs by adjusting both sampling time and duration.
b) After the initial graph data is accepted, the print-out shall be changed from a fixed interval to a change of value.

8. Tests that fail to demonstrate proper system operation shall be repeated after Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.

B. Acceptance:

1. After tests described in this specification are performed to the satisfaction of both Engineer and Owner, Engineer will accept control system as meeting completion requirements. Engineer may exempt tests from completion requirements that cannot be performed due to circumstances beyond Contractor's control.
2. System shall not be accepted until completed demonstration forms and checklists are submitted and approved as required in Section 23 09 23 Article 1.9 (Submittals).
3. After start-up and calibration, Building Controls Contractor shall submit to the Engineer trend logs of all points on each system demonstrating stable and proper operation. The trend logs shall be as follows:

a. 24 hour period at 15 minute intervals.
b. 3 hour start-up period at 5 minute intervals.
c. A total of two sets covering two days during each period are required.

3.15 TRAINING – **NOT PROVIDED**

A. Provide training for a designated staff of Owner's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.

B. Provide as part of this contract on site training for four facility operators (two advanced and two basic level) as designated by the Owner.

C. A total of 40 hours of on the job owner training conducted by a technician or technicians fully qualified to conduct such training shall be provided. Instruction or Training shall include, but not be limited to:

1. Instructions in the manufacturers recommended maintenance and operating procedures.
2. Instructions in the detailed sequence of operation of the mechanical equipment controls.
3. Instructions in reading and using the control wiring diagrams.
4. Instructions in control setpoint adjustment as relating to each specific system provided under this section.
5. Performance testing as described in Part 3.

END OF SECTION 23 09 23

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SECTION 23 09 25
VARIABLE FREQUENCY DRIVE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 WORK INCLUDED

A. Variable Frequency Drives: Provide and install Variable Torque Variable Frequency Drives (VFD) for variable speed where indicated on the plans, suitable for controlling NEMA Design B motors on continuous duty in variable volume applications. The VFD shall be listed by Underwriter's Laboratories, E.T.L., or CSA as approved by the Engineer and shall comply with the latest standards of ANSI, IEEE and the NEC.

B. General: The Variable Frequency Drive shall be capable of converting 460V + 10%-5%, three phase, 60 Hz + 2 Hz utility input power to variable frequency, three phase AC power for variable torque motor control continuously from 10% to 110% of base speed. Output shall have voltage to frequency relationship for a 460V, three phase motor. A transformer shall not be required for the input or output to operate on 460V. All general options and modifications shall mount within the VFD enclosure.

C. Basis of Design: Basis of this design is Graham Model 1576 for purposes of conveying the minimum acceptable level of performance and control interfaces. Variable Frequency Drives manufactured by ABB, Trane, or Yaskawa will be considered acceptable if all provisions of this specification can be met. Other manufacturers who can comply with all provisions of this specification shall be required to submit technical information brochures for pre-bid approval, in accordance with the provisions of Section 23 01 00.

D. Submittals: Provide submittals in accordance with Paragraph titled "Power Factor" of this Section and with Section 23 01 00. In addition, furnish the following technical information for Engineer's review and approval:

1. Complete technical information on the Variable Frequency Drive and all specified options, indicating all cabinet dimensions and space requirements for the VFD, including bypass contactors and line reactors.
2. Complete efficiency versus load and speed data for all VFD ratings showing that the VFD with necessary isolation transformers or line reactors is capable of providing full motor nameplate rated horsepower.

E. Power Factor: The power factor shall be maintained at 0.95 throughout the speed range of the drive.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions" for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the drawings and specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Direct Digital Control System and Expansion.
2. Performance Verification.
3. Air Handling Units.
4. Fans, Utility.
5. Electrical sections.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The VFD unit shall be totally enclosed in a free-standing NEMA 1 enclosure for floor mounting, and shall be capable of dissipating any heat generated by the VFD circuitry. All unit-mounted controls shall be mounted on the face of the VFD enclosure. VFD shall be capable of operating in an ambient temperature of 0-40^{o}C.

B. The VFD shall incorporate an input molded case circuit breaker sized to provide a short circuit interrupting capacity of 30,000 symmetrical amps. The input breaker shall be mechanically interlocked with the power unit enclosure door.

2.2 UNIT REQUIREMENTS

A. Control Interface: The following control interfaces shall be provided at a terminal strip in the VFD as a minimum to assure control system integrity:

B. Speed Control Input: A 4-20mA signal proportional to speed shall be furnished under Section 23 09 23 to the Fan System for directly controlling the speed of the VFD's when in automatic mode in response to static pressure.

C. Start/Stop Control: The VFD shall be capable of being started and stopped remotely by a maintained-contact start/stop relay furnished in this section and other remote relay contacts.

D. Control Interlock: The VFD shall provide an auxiliary control interlock output of 115 VAC whenever the VFD is enabled, to provide interlocking with the control system. The VFD shall be furnished with two sets of N.O. contacts for control interlocking. The VFD shall be provided with a 115 VAC control transformer so that no external 115 VAC power source is required.

E. Speed Signal Reference: The VFD shall furnish a 0-5 VDC or 4-20mA signal directly proportional to the output frequency of the VFD, for remote monitoring of the VFD speed at the building automation system under Section 23 09 23.

F. Hand-Off-Auto Switch: The VFD shall be furnished with a door-mounted Hand-Off-Auto switch to allow switching of the speed control signal from the "Automatic" signal to a manually selected speed potentiometer on the VFD when in the "Hand" position. The VFD shall be disabled when in the "Off" position.

G. VFD Trip Contacts: The VFD shall be furnished with a set of N.O. contacts for remote annunciation to the building automation system under Section 23 09 23.

H. Speed Potentiometer: A manually selected speed potentiometer shall be door-mounted to manually select the speed when the H-O-A switch is in "Hand" position.

I. Speed Meter: The VFD shall be furnished with a door-mounted speed meter (0-100%) to indicate the frequency of the VFD.

J. Manual Bypass with Magnetic Contactors: A door-mounted manual bypass switch shall be provided as a means of bypassing the VFD circuitry for emergency operation. In "normal" mode, the motor is controlled by the VFD. In "bypass" mode the motor is directly connected to the building power. Motor protection thermal overload shall be provided in "bypass" or "normal mode".

K. Manual bypass shall provide all the circuitry necessary to safely transfer the motor from the VFD to the power line, or from the line to the controller, while the motor is at zero speed. This option shall be located in the VFD cabinet. This enclosure section shall house all devices which must be energized at either 460 VAC or 115 VAC while operating in the bypass mode, for personnel safety.

1. Two motor contactors, electrically interlocked, shall be utilized. One contactor is to be between the VFD output and the motor, controlled by the VFD regulator; and the other one is to be between the bypass power line and the motor, providing across-the-line starting. Motor protection is to be provided in both the "normal" mode and the "bypass" mode by a motor overload relay. The 115 VAC relay control logic, allowing common start-stop commands in the "controller" mode and the "bypass" mode shall also be included within this enclosure.
2. The bypass section door shall include a "VFD-Off-Bypass" selector switch and "VFD Mode" indicator light and a "Bypass Mode" indicator light. Terminals shall be provided for remote light indication of mode selection.
3. The bypass option shall include a door interlocked, main power input disconnect circuit breaker, providing positive shutdown of all input power to both the bypass circuitry and the VFD.
4. The bypass circuit shall include a second door interlocked input disconnect circuit breaker installed in the VFD. This disconnect shall provide the ability to safely troubleshoot and test the controller, both energized and de-energized, while operating in the "bypass" mode.
5. Manual bypass with magnetic contactors shall be factory installed.

L. Variable Frequency Drive Controller: The VFD controller shall be completely solid state PWM or variable voltage source design. The VFD shall provide the following standard features:

1. Minimum and Maximum Speed Potentiometers shall be furnished to select a minimum (10-50%) and maximum (50-100%) output frequency.
2. Linear acceleration and deceleration functions adjustable from 4-20 seconds shall be furnished.

3. Safety features shall be provided to protect the VFD internal circuitry and motor, including but not limited to the following:

    a. Current limit feature to limit output current from 50-110% of that of the inverter rating. The current limit shall be designed to function automatically to prevent overcurrent trip due to momentary overload conditions, without shutdown.
    b. Instantaneous overcurrent trip to safely limit the output current in under 50 micro seconds due to phase to phase short circuits or severe overload conditions, without damage to input fuses or thyristors.
    c. Under- and over-voltage trip for non-momentary power or phase loss. Automatic restart shall occur on undervoltage condition.
    d. Drive diagnostic fault indicator for continuous indication of drive status.
    e. Isolated current and voltage signals from logic circuitry.
    f. Fast-acting current limiting input fuses.
    g. In the event of a sustained or momentary power loss, the control shall shut down safely without component failure. Upon return of power, the system shall automatically return to normal operation.
    h. In the event of phase to phase short circuit on the output due to motor failure or power failure the control shall shut down safely without component failure.
    i. Overtemperature safety shall be provided to shut down the VFD if the internal temperature becomes excessively high.
    j. Solid-state ground-fault protection and indication shall be provided with the VFD.

    k. VFD shall not require external 120 volt control circuit to perform any of the functions listed herein. Any control power required shall be provided internally from the VFD.
    l. Motor Thermal Overload Protection shall be provided with door- mounted reset button and integral adjustments for the exact motor full load amps. Motor thermal overload relay shall be mounted inside the VFD cabinet.

M. Line Noise: The Variable Frequency Drive shall be furnished with Class H dry type isolation transformers, Class H insulation line reactors and other line noise filtering devices as required to prevent line noise from being transmitted into the AC power system. The line noise shall be no greater than 3% Harmonic Distortion and no more than a 16,400 volt-microsecond commutation notch area, in accordance with IEEE Standard 519-1981 for Special Applications. Line noise testing shall be accomplished at the jobsite with a spectrum analyzer to determine line noise levels. Line reactors or filters should be considered in sizing the VFD units to ensure that the overall power conversion efficiency does not reduce the fan capacity below that listed in the fan schedule.

N. Efficiency Rating: Complete efficiency versus load and speed data for all VFD ratings shall be submitted and shall be no less than 95% at 100% speed and 87% at 60% speed.

O. Factory Testing and Warranty: Each VFD shall be factory tested to insure reliability. Testing shall include component thermal cycling, logic system simulation tests and full load operation tests. The VFD shall be heat tested with power on for 50 hours at 50oC. VFD shall be furnished with manufacturer's written certification of tests conducted and shall be warranted for one full year (from date of startup) against component failure.

P. Diagnostic Features: The VFD shall contain diagnostics to allow on-site troubleshooting of fault conditions through built-in diagnostic indicators or through a diagnostic tester. One diagnostic tester must be included with the VFD package, to provide a functional test of each regulator card through a prewired diagnostic test port.

PART 3 - EXECUTION

3.1 GENERAL

A. Start-up Service: Provide the services of a factory-trained service technician during startup to ensure that the VFD units have been installed and wired correctly and that the factory-recommended startup procedures are followed for each of the VFD units installed.

B. Instructional Period: Provide one 8-hour instructional period to the Owner's maintenance personnel, scheduled at the Owner's convenience during the Warranty period, to provide instruction on the design, operation and maintenance of the Variable Frequency Drives.

END OF SECTION 23 09 25

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SECTION 23 21 15
PREINSULATED UNDERGROUND PIPING SYSTEM

PART 1 – GENERAL

1.1 MECHANICAL GENERAL PROVISIONS

A. Provisions of the section “General Mechanical Provisions” shall be made part of this section.

1.2 QUALITY ASSURANCE

A. The supplier of the pre-insulated piping system shall be responsible for the design of the complete engineered pre-insulated piping, including carrier pipe selection, thermal insulation, protective jacketing, fittings, anchors, thrust block design, and expansion loops or expansion elbows if required.

B. If underground piping system includes Heating Hot Water piping, provide complete pre-insulated pipe manufacturer certified drawings and stress calculations indicating all provisions as outlined in 1.3.A. These drawings and stress calculations are not required for 2 pipe only chilled water systems.

C. Manufacturer shall provide a qualified technician who will be present during critical periods of the installation and testing of the system. Technician must be in the direct employ of the system Manufacturer. Technician to provide written field service reports to the Owner’s representative for all jobsite meetings. This Certified Technician service shall be priced as part of the overall project scope and shall not be an extra cost to the project owner.

D. After installation and prior to backfill, the manufacturers representative of the piping system shall field inspect the piping system and certify in writing to the Owner’s representative that the piping system has been assembled and installed within the guidelines of the manufacturer’s written installation instructions. This certification shall include, but not be limited to, trench preparation, anchor and thrust block construction and location, backfill material, expansion loop and field joint construction.

1.3 SUBMITTALS

A. Submit details of pre-insulated piping system components including carrier pipe selection, thermal insulation thickness for each pipe size, and jacket selection.

B. Submit details of joint construction, expansion loop sizing, anchor and thrust block construction, and field insulation procedures for joints and fittings.

C. Submit pipe installation field service inspection report as described in 1.2.C.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pre-insulated Underground Piping System:

1. Energy Task Force
2. Perma Pipe / Ricwil
3. Rovanco Piping Systems
4. Thermal Pipe Systems

2.2 FABRICATION

A. Pre-insulated Underground Piping System:

1. Temperature range 30 F to 250 F

a. Carrier Pipe:

1) Piping, ¼" through 1 ½": Schedule 40 carbon steel, seamless ASTM A-106 OR Type K copper per ASTM B-88.
2) Piping, 2" through 10": Schedule 40 carbon steel, electric resistance welded, ASTM A-53.
3) Piping, 12" and larger: Standard weight carbon steel, electric resistance welded, ASTM A-53.
4) Where possible, provide in nominal 40 foot lengths to minimize number of field joints. Allow 6" of exposed pipe to permit field joining. Size as shown on drawings.

b. Fittings: Schedule to match carrier pipe, carbon steel, butt weld, ASTM A-234. Manufacturer to provide fitting insulation kits for field insulation of fittings including hard shell mitered jacket equal in thickness to carrier pipe jacket with field applied urethane insulation and pressure sensitive tape. The use of interior PVC "zeston" style covers is not acceptable.
c. Insulation: 2 pound density polyurethane foam, 90% to 95% closed cell, K factor of .14 Btuh/sq ft/deg F/in, 2" nominal thickness.
d. Jacket: High impact seamless polyvinyl chloride(PVC) class 12454B compound conforming to ASTM 1784, Type 1, Grade 1 for pipe sizes 12" and smaller. High density polyethylene(HDPE) casing Type III, category 5, class C, conforming to ASTM D-1248 for pipe sizes 14" and larger.
e. End Seal: Provide high temperature black mastic end seal on each end of each length of pre-insulated pipe. Provide extra mastic end seal material during installation for field cut pipe. At no time during installation should insulation be directly exposed to elements.
f. Provide all necessary expansion loops, expansion elbows, anchors, wall sleeves and all necessary accessories for field assembly and insulation of fittings and straight joints.
g. Basis of design Energy Task Force ETF-MT.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install in accordance with manufacturer's written installation instructions, including but not limited to unloading and storing of product, field application of factory end seal material for all field cut pipe, trenching with proper attention to required cover height, concrete anchor block construction, laying, welding, field joint insulation procedure, and fitting insulation procedure.

B. Prior to insulating and sealing of joints and fittings the piping system shall be visually and hydrostatically tested as specified in Performance Verification sections.

C. Comply with inspection and certification requirements as specified in 1.2 – QUALITY ASSURANCE.

END OF SECTION 23 21 15

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SECTION 23 21 25
PUMPS, HORIZONTAL BASE MOUNTED END SUCTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide single stage, end suction, vertically split case centrifugal pumps as specified herein and /or shown on the drawings.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications. Coordinate, where applicable, with variable speed drive systems.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Include data on: materials of construction dimensions; weights; curves; brake horsepower requirements; motor horsepower; drive couplings; efficiencies; coupling guards; and operating and maintenance instruction. Pump curves shall be clearly marked to show pump performance at scheduled points and, where pumps must operate in parallel, both single and parallel operating points. Where pumps are specified with variable speed drives, provide operating curves at fifty (50) rpm increments throughout the specified operating range.

1.5 SELECTION AND CAPACITY

A. Each scheduled pump has been selected near its point of maximum efficiency. Pumps which may be proposed which are other than those used as a design basis must be selected with the same considerations of efficiency, impeller diameter and other characteristics to be capable of providing the capacity intended.

B. Pumps and motors shall be selected to provide a non-overloading assembly regardless of pressures and flow rates which may be actually encountered in the system.

C. Impeller Selection: Selected to operate efficiently at the scheduled points and shall be neither the largest nor smallest impeller for the selected pump casting.

D. Motor horsepowers scheduled have been selected to be non-overloading at any point on the pump curve of the scheduled pump and this condition must hold true of any pump proposed for this service.

1.6 MANUFACTURER

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Allis Chalmers
2. Buffalo
3. Chicago
4. Taco
5. Peerless
6. Paco
7. Aurora
8. Bell & Gossett
9. Weinman
10. Mueller
11. Amtrol
12. Crane
13. Armstrong
14. Patterson

PART 2 - PRODUCTS

2.1 GENERAL

A. Pumps: Horizontal mount, vertically split case, single stage, end suction, centrifugal pumps of the quantity, size and capacity indicated.

B. Casing: Split on the vertical axis. Close grained cast iron. Casing shall be designed for 175 psi working pressure and shall be hydrostatically tested at 150% of the maximum working pressure Suction and discharge flanges shall be drilled to ANSI Standards.

C. Impeller: Cast bronze. Keyed to the shaft and securely retained in an axial position by positive mechanical means.

D. Drive: Motor's horsepowers scheduled have been selected to be non-overloading at any point on the pump curve of the schedule pump. Pumps proposed must comply with this condition.

E. Mechanical Seals: Designed for operation in 225ºF liquid and mounted in one piece cast construction stuffing boxes. Stuffing boxes shall include provision to flush the seal faces.

F. Bearings: Radial and thrust bearings shall be single row ball, grease lubricated, self-aligning type mounted in cast iron cartridges. Sized for 20,000 hours B-10 life which is 100,000 hours average life. Removable without disassembling the pump.

G. Coupling Guard: Provide coupling guard for each pump.

H. Base: Steel drip rim base for each pump unit. Pump and drive unit carefully aligned and bolted in place prior to factory shipment.

I. Motors: Open drip proof with greaseable ball bearings. Motors installed outdoors, in unprotected areas, or subject to exposure to moisture shall be TEFC type. Where variable frequency drives are employed, or as otherwise directed, provide motor of high efficiency type; coordinate with variable frequency drives.

PART 3 - EXECUTION

3.1 GENERAL

A. Install pumps where indicated, in accordance with manufacturer's published installation instructions, with recommended clearances provided for service and maintenance. Pump placement shall be essentially as shown on drawings; however, actual location shall be verified using field measurements and data relating to actual pumps and adjacent equipment as actually approved for installation on this project.

3.2 PIPING AND ACCESSORIES

A. Provide piping, accessories, hangers, supports, and anchors; valves; meters and gages; vibration isolation; and equipment supports; as indicated for complete installation.

B. Provide all necessary unions and/or flanges on all appropriate items so that all items (strainer, flexible connection, suction diffuser, pump, balancing cock, check valve, etc.) between suction side gate valve and discharge side gate valve can be easily replaced and/or serviced without disturbing any other portions of the system.

END OF SECTION 23 21 25

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SECTION 23 23 13
REFRIGERANT PIPE, VALVES AND SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide refrigerant piping systems, complete in all respects, between the system components and connected equipment.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

A. Refer to the Section entitled "General Mechanical Provisions".

PART 2 - PRODUCTS

2.1 COPPER PIPE

A. Refrigerant system piping shall be refrigerant grade, dehydrated and sealed, seamless, uniformly dead soft temper.

2.2 FITTINGS

A. Refrigerant grade, wrought copper, long radius, solder joint type.

2.3 SOLDER

A. Silver brazing alloy (Sil Fos) Fed. Spec. AA-S-56ld.

2.4 FLUX

A. Non-corrosive, specifically designed for silver brazing.

2.5 ACCESS VALVES

A. Schrader type designed for use with quick coupler hose fittings and provided with individual cap.

PART 3 - EXECUTION

3.1 PIPE SIZES

A. Refrigerant pipe sizes which may be shown on drawings are nominal. Provide sizes not less than sizes indicated and in compliance with size recommended by the manufacturer(s) at the connected equipment. Provide change in sizes if such change is in accord with manufacturer's recommendation and with Architect/Engineer's approval. Size piping to maintain minimum velocity of 500-fpm in horizontal lines and 1000 fpm in vertical risers for proper oil return; provide double suction risers and hot gas risers as may be necessary to accomplish this.

3.2 REFRIGERANT SPECIALTIES

A. Refrigerant valves, driers, expansion valves, and similar items shall be provided with each system. Where refrigerant access valves are not furnished by the manufacturer, they shall be field installed to enable charging and checking the system.

3.3 JOINTS AND CONNECTIONS

A. General: All joints and connections shall be made permanently refrigerant tight.

B. Solder Joints: Cut tubing square using tubing cutters, with sharp cutting wheels, so as not to crimp the tubing ends. Remove all burrs using a pipe reamer and taking care not to flare the ends of the tube. Thoroughly clean the outside of the pipe and the inside of the fitting using a fine sand cloth. Apply non-corrosive paste flux to the cleaned surfaces immediately and apply silver solder and heat in accordance with manufacturer's instructions. Use care not to damage equipment or refrigerant specialty items when making up joints (protect from excessive heat).

C. Scale Prevention: During brazing, keep pipe system full of inert gas to prevent scale formation.

D. Mechanical Joints: Where the Contractor uses refrigerant tubing sets, follow the manufacturer's installation instructions explicitly, including the use of special tools, when making up the joints. Where precharged tubing and equipment is provided, do not cut into the system to install access valves.

3.4 HANGERS AND SUPPORTS

A. Refer to other sections describing hangers and supports. Isolate copper tubing from contact with any dissimilar metals.

3.5 EVACUATION AND CHARGING

A. When other than completely factory charged equipment and piping systems are used, they shall be evacuated and charged as follows: Charge the system with dry nitrogen and refrigerant and leak test all joints including factory piping within the units. Repair all leaks by disassembling and remaking the joint. After all leaks are corrected, evacuate the system to an absolute pressure of 0.2" mercury. System shall hold this vacuum for two hours with no noticeable rise in pressure. After passing vacuum test, break vacuum twice using refrigerant and re-evacuate for a minimum of two hours each time. Charge the system in the manner and with the type and amount of refrigerant recommended by the manufacturer and in accordance with accepted refrigeration practice.

3.6 REFRIGERANT PIPING CONDUIT

A. Install any refrigerant piping which is below slab or grade in Schedule 40 PVC piping. Size conduit as necessary to properly install piping. Provide long bend sweeps. Install so that conduit will drain and not trap water. Protect ends of conduit from entry by vermin, insects and water.

3.7 OTHER REQUIREMENTS

A. Arrange piping generally as shown and such that service access is facilitated. Keep refrigerant lines as short and direct as possible with a minimum number of joints. Provide sleeves through floors, walls or ceilings, sized to permit installation of full-thickness insulation; seal air tight after installation of piping and insulation.

B. Provide flexible piping arrangement in hot gas discharge line of compressor. Such arrangement shall consist of a piping loop or similar measure to prevent transmission of objectional vibration.

C. Provide a removable core filter-drier in liquid line. In-line filter-driers are acceptable in individual circuits of less than 10-ton nominal capacity. Provide a full size valved bypass around this filter-drier. Provide shut-off valves to isolate the filter drier while flow is through the bypass and also a shutoff valve in the bypass so that filter-drier can be put into use.

D. Provide a refrigerant charging connection in the liquid line upstream from the filter-drier.

E. Provide a moisture indicating sight glass in the liquid line downstream from the filter-drier. Install in vertical line if possible and a sufficient distance downstream from any valve such that the resulting disturbance does not appear in the glass.

F. Provide a filter-drier with isolating shut-off valves and with valved bypass only if compressor is not equipped with a suction line filter or screen.

G. Keep piping free from traps unless otherwise indicated. Install vertical pipe plumb. Pitch horizontal piping only where slope is desirable.

H. Provide shut-off valves at inlet and outlet to all condensers, receivers and evaporators to permit isolation for service. If possible, use angle valves to minimize pressure drop. Use angle valves in all cases at receivers. Use globe valves only when angle valves are impractical.

I. Provide solenoid valves upright in horizontal lines only, unless their design allows installation in vertical pipe.

J. Where compressor(s) do not have pump down control and the compressor(s) associated evaporator coil(s) do not have bottom suction header connections and the evaporator coil(s) are located above the compressor(s), then loop suction lines(s) to top level of coil to prevent liquid slugging.

K. To prevent erratic operation of thermal expansion valve, provide a suction line trap next to evaporator coil suction outlet with expansion valve bulb located between coil and trap. Provide only in suction lines which are level leaving coil outlet or which rise on leaving coil outlet. Trap not required when evaporator coil outlet suction line drops to compressor or suction header immediately after expansion valve bulb.

END OF SECTION 23 23 13

SECTION 23 25 00
WATER TREATMENT SYSTEMS: CHILLED WATER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Scope: Provide complete water treatment systems for chilled water system. Provide water treatment systems as indicated on the drawings and specified herein and provide all plant, materials, equipment and labor required to flush and clean the new piping systems prior to operation.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications.

B. The chillers shall not be operated until all work of this Section is complete and the initial treatment begun. Coordinate the installation of all piping system mounted equipment control with all trades involved to insure a timely and workmanlike installation.

1.4 SHOP DRAWINGS

A. Include specific data on: all chemicals; controls, feeders, pumps; blow down valves and like items; as well as complete power, control and interlock wiring diagrams. Include complete operating and maintenance instructions.

B. Shop drawings for each complete chilled water treatment system and its chemicals shall include catalog descriptions of all components, written functional descriptions of all operation phases, shop drawings showing arrangement of all components and their enclosing cabinetry, schematic flow diagrams of all treatment system related piping to and from where such piping components connect into and are located in the other piping systems, and all other information necessary to assure that the treatment system(s) are satisfactory and completely as specified.

1.5 PRESSURE AND TEMPERATURE RATINGS

A. Unless otherwise specified in this section, components of this equipment or system (specified by this section) which are connected to the fluid system (chilled water, potable water, etc.) to which this equipment or system serves shall be recommended and rated for same (or greater) maximum working pressure and temperature conditions which are applicable to the fluid system at the location(s) at which the equipment and systems of this section are

installed. Refer to specification section(s) describing the related fluid systems(s) for pressure and temperature ratings applicable to the components of this section.

1.6 MANUFACTURER QUALIFICATIONS

A. Chemicals, service and equipment shall be supplied by a single water treatment company for undivided responsibility.

B. The water treatment chemical and service supplier shall be a recognized specialist, active in the field of industrial water treatment for at least ten years, whose major business is in the field of water treatment, and shall have regional water analysis laboratories, development facilities and service department, plus full-time personnel located within the trading area of the job site.

1.7 MANUFACTURERS

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Mogul
2. Mitco
3. Betz

PART 2 - PRODUCTS

2.1 CHEMICAL TREATMENT SYSTEM - CHILLED WATER

A. For the chilled water system, provide a shot feeder with funnel, and air release valve, minimum five gallon capacity and designed to meet pressure requirements of the system.

2.2 WATER TREATMENT CHEMICALS - CHILLED WATER SYSTEM

A. Furnish one year's supply of recommended formula for scale and corrosion preventative protection of closed recirculating system. Formulation shall not contain any ingredients which are harmful to system materials.

2.3 TESTING EQUIPMENT

A. Furnish basic water test equipment including spare reagents for maintaining control of program standards in the chilled water systems.

B. Provide one test cabinet suitable for wall mounting for storage of testing glassware and reagents. The cabinet will have one shelf, keylock door and fluorescent light. Cabinet shall be constructed of 18 gauge, cold-rolled steel, primed and painted with white, polyurethane enamel paint for corrosion protection.

C. Corrosion Testing Assembly: Provide a coupon by-pass assembly to monitor effectiveness of the corrosion prevention program. This prefabricated assembly shall include:

1. 1" inlet and outlet shut-off valves.
2. 1" line strainer with 20 mesh stainless steel screen.
3. Corrosion probe connection fitting.
4. Two (2) corrosion coupons with holders.
5. Two (2) corrosion coupon tees.
6. Flow control valve.

D. Corrosion coupons will be analyzed by standard laboratory test methods and test reports provided at six month intervals.

E. Basis of Design: Mogul Packaged Microchem 4000.

PART 3 - EXECUTION

3.1 GENERAL

A. Install chemical feeding systems as indicated, in accordance with manufacturer's installation instructions, and with recognized industry practices, to insure equipment complies with requirements and serves intended purposes.

3.2 SHOT FEEDERS

A. Install shot feeders as indicated with adequate pressure differential restrictive devices to permit flow through the chemical feeder body. Connect feed piping to inlet and outlet connections with shutoff valves. Pipe drain valve discharge to floor drain.

3.3 CLEANING AND FLUSHING

A. All chilled water lines and related equipment shall be thoroughly flushed out with precleaning chemicals designed to remove deposition such as pipe dope, oils, loose rust and mill scale and other extraneous materials. Add recommended dosages of precleaner chemical products and circulate throughout the water system. The chemical supplier shall instruct as to the proper feed rates, shall check that the cleaning solution is actually in each system, shall instruct the Contractor as to when to flush the system and shall check each system following flushing to insure all cleaning chemicals have been removed from each system. Mechanical trades shall open all modulating valves, zone valves and all other system restrictions. Drain, fill and flush water system until no foreign matter is observed and total alkalinity of the rinse water is equal to that of the make-up water.

1. Chemical used for cleaning of systems shall comply with the recommendations of the manufacturers of the major components in the system.
2. A certificate of cleaning shall be provided by the cleaning chemical supplier to the Owner.
3. Following system flushing, upon initial fill, the approved chemicals which provide a protective coating are to be added to prevent oxidation of the piping system.

3.4 MANUFACTURER'S SUPERVISION

A. Provide the services of a representative of the water treatment control manufacturer and the water treatment supplier to provide supervision of the system installation and operation check out and startup service for the complete water treatment system.

3.5 EQUIPMENT PLACEMENT AND MOUNTING

A. The equipment and devices shall be located essentially as shown on the drawings; however, actual placement shall be verified using field measurements, installation diagrams and data relating to the equipment actually approved for installation on this project. The equipment, including accessory devices, shall be mounted in strict accordance with the manufacturer's instruction in such a manner as not to compromise service or operational access to any part of the system or to existing equipment.

3.6 PIPING

A. Installation of chemical piping shall be made in strict compliance with the tube and fitting manufacturer's recommendations.

3.7 OPERATING INSTRUCTIONS

A. Provide the services of an authorized representative of the automatic water treatment control manufacturer and the water treatment supplier to provide on site operating and service instruction of the Owner's designated operating personnel for a period not less than one day (8 hours). Instructions in routing maintenance, testing and control shall be given to Owner's authorized personnel in person by the chemical treatment specialist. This shall be done at the site. Typewritten instructions shall also be provided. Copy of instructions shall be signed by Owner's authorized personnel and sent to engineer by the contractor. Test kits shall be provided to Owner and receipt thereof acknowledged on copy of written instructions which are sent to Engineer.

3.8 OTHER REQUIREMENTS

A. Provide all necessary pipe, valves, fittings, unions and other items necessary for proper installation.

B. Locate shot type feeder in valved bypass from pump discharge to pump suction. Provide gate valve in bypass on each side of feeder.

C. All components (including pumps, meter, piping, hose, valves, etc.) and their capacities shall be properly sized for proper chilled water treatment.

END OF SECTION 23 25 00

SECTION 23 31 00
DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide complete duct systems as indicated. Systems shall include, but not be limited to, the following: outside air, exhaust air, and air conditioning supply and return air duct systems as shown on drawings. Drawing scales prohibit the indication of all offsets, fittings, and like items; however, these items shall be installed as required for the actual project conditions at no change in contract price.

B. Items Included: This section generally includes, but is not limited to, the following major items:

1. Low pressure sheet metal ductwork.
2. Acoustical thermal duct liner.
3. Low pressure flexible ducts.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions" for related requirements. Refer to other sections of Division 23 and to other applicable portions of the Drawings and Specifications.

B. This section is directly related in particular to sections (which may or may not be included in this division) which describe the following:

1. Sections describing air handling equipment and fans.
2. Air distribution devices.
3. Terminal units.
4. Duct system accessories.
5. Insulation.

C. Coordinate shop drawings, ordering, delivery, and placement of all items affecting the duct systems including, but not limited to, the following items: air handling units, exhaust fans, supply fans, sound attenuators, duct mounted coils, access panels, air distribution devices, fire dampers, outside air louvers, hoods, filters, roof curbs, structural framing, roof construction, roofing, and the work of all trades to insure an orderly and timely progression of the work. Refer to the requirements of Section entitled "General Mechanical Provisions".

D. Refer to other sections which may describe additional sound attenuation measures which may relate to this section.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Include complete data as applicable to this project on: all prefabricated duct and fittings; duct liner including mechanical fasteners and adhesives; duct sealing materials; duct joining and seaming methods; and all other items.

1.5 OTHER REQUIREMENTS

A. Provide all ductwork and components thereof in accord with manufacturer's recommendations. All ductwork dimensions indicated are nominal free clearance internal dimensions which do not include insulation thickness.

1.6 DEFINITIONS

A. "SMACNA" means "Sheet Metal and Air Conditioning Contractors National Association, Inc."

B. Low Pressure Ductwork: Any and all ductwork conveying air or other gases at velocities less than 2500 fpm and static pressure less than 2.0 inches wg. This ductwork may also be referred to in these specifications as "Low Velocity Ductwork". SMACNA "HVAC Duct Construction Standards, Metal and Flexible", latest Edition, shall govern construction of this ductwork unless otherwise specified.

C. High Pressure Ductwork: Any and all ductwork conveying air or other gases at velocities equal to or greater than 2500 fpm or static pressure equal to or greater than 2.0 inches wg. This ductwork may also be referred to in these specifications as "High Velocity Ductwork" or "Medium Pressure Ductwork", but shall be considered, in either terminology, to fall within pressure/velocity class (PV/C designation) 3 to 10. SMACNA "HVAC Duct Construction Standards, Metal and Flexible", latest Edition, shall govern construction of this ductwork unless otherwise specified.

1.7 PRESSURE/VELOCITY CLASSIFICATIONS

A. Pressure and velocity classifications (hereinafter called "P/VC") for ducts are defined as follows:

P/VC Desig.	SMACNA Pressure Class	Static Pressure Rating	Positive or Negative Pressure	SMACNA Seal Class	Maximum Velocity (fpm)
10	High	10"	+	A	2000 up
6	Medium	6"	+	A	2000 up
4	Medium	4"	+	A	4000 dn
3	Medium	3"	+ or -	B	4000 dn
2	Low	2"	+ or -	C	2500 dn
1	Low	1"	+ or -	C	2500 dn
½	Low	1/2"	+ or -	C	2000 dn

B. See Part 3, EXECUTION, of this section for duct sealing requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall comply with current SMACNA standards.

B. ASTM: Unless otherwise specified, ASTM material specifications applicable are:

Material	Type	ASTM Number
Galvanized steel	G90	A635
Stainless steel	304,316	A240
Cold rolled steel	20-28 ga.	A366
Cold rolled steel	18 ga.	A619
Aluminum	3003 H-14	B609

C. Special Materials, Gauges and Construction:

1. Special Materials: Where special duct material other than galvanized steel is required, such duct material (e.g., fiberglass, stainless steel, plastic such as polyvinylchloride, etc.) shall be specifically indicated.
2. Gauges: Gauges indicated in this section are for galvanized steel. Where greater or lesser gauges are specifically indicated for a sheet metal material other than galvanized steel, provide the indicated gauge. Comply with the SMACNA construction standard covering the required material if no gauge is given.
3. Construction: Comply with indicated special requirements (i.e., such as welding, soldering, etc.) where application requires.

2.2 LOW PRESSURE SHEET METAL DUCTWORK

A. Material: Prime quality forty-eight inch wide resquare tight coat galvanized steel conforming to the requirements of ASTM A-635 and/or A-527 as applicable to the intended use.

B. Construction:

1. Construct to comply with the pressure/velocity classification(s) indicated.
2. Use rectangular or round as indicated on drawings.
3. Reinforcing, Cross Breaking, Seams, Joints: Be in accord with latest SMACNA construction standard for low pressure sheet metal duct.
4. Gauge: As required by SMACNA for the dimensions and pressure/velocity classification involved.

C. Insulation:

1. Rigid sheet metal ductwork: Where low pressure ductwork is designated to have internal acoustical/thermal liner, provide factory fabricated double wall ductwork as specified for high pressure round acoustically lined sound attenuating duct (i.e., factory fabricated double wall duct with perforated inner wall).

2.3 ACOUSTICAL THERMAL DUCT LINER

A. Line ductwork where indicated. Dimensions indicated are net inside dimensions. Liner shall be one inch thick, three pound density fiberglass duct liner with the surface in contact with

moving air stream stabilized with black pigmented neoprene. Duct liner shall comply with requirements of NFPA 90A as to flame spread and smoke developed ratings. Duct liner shall be factory treated with antimicrobial/antibacterial treatment to prevent formation & growth of bacteria.

B. Acceptable Manufacturers: Johns-Manville, Microtex; PPG Industries, Testrafine; or Certain-Teed/Saint Gobain, Coated Ultralite.

C. Attachment: Attach to the interior of sheet metal ducts using a full coverage coat of Foster's 85-20 adhesive and mechanical fasteners applied as follows:

1. Horizontal Ducts: Install mechanical fasteners on underside of the tops of ducts over twelve inches in width and on the insides of ducts over sixteen inches in height.
2. Vertical Ducts: Install mechanical fasteners on all duct surfaces exceeding twelve inches.
3. Fastener Spacing: Install fasteners within two inches of the leading edge of each duct section and within three inches of the leading edge of cross joints in insulation within any given duct section. Pins shall thereafter be spaced at not more than fifteen inches on centers. Pins shall be installed in strict accordance with manufacturer's instructions.

D. Edge Stabilization: All exposed edges and the leading edge of all cross joints of liner shall be coated with Foster's 30-36.

2.4 LOW PRESSURE FLEXIBLE DUCTS

A. General:

1. The inclusion of flexible ducts in this specification shall not be construed as approval of use on the project unless specifically shown on the Drawings.
2. Where used, provide in factory finished lengths not in excess of lengths required to make kink-free connections with minimum air pressure drop.

B. Insulated flexible ducts: Flexible duct shall be factory-fabricated preinsulated type with seamless vapor barrier. Duct shall bear UL 181 Class 1 Air Duct label and shall comply with NFPA 90A and 90B. Fiberglass insulation nominal 1" thickness with thermal conductance of 0.23 BTU/hr-ft2-ºF maximum at 75ºF mean temperature. Flexible duct shall have an operating range of minus 0.5" w.g. to plus 2" w.g. Core shall be continuous and consist of aluminized mylar laminated to corrosion resistant steel wire helix. Vapor barrier perm rating shall be 0.17 maximum per ASTM E96-A. Maximum working velocity shall be 4000 FPM. Flexible duct shall be Genflex SLR-25, Clevaflex Type KQ, Wire Mold type WG, Flexmaster Type 5B, or approved equal.

C. Un-insulated flexible ducts, steel: Flexible ductwork shall be constructed of all metal one ply hot-dipped galvanized steel, closely corrugated for strength and flexibility, with seams interlocked, folded flat, and knurled to insure tightness. Duct shall be listed as #UL181 "Flexible Air Duct", Class 1, and NFPA 90A. Products shall be Flexmaster Type NI-TL, Clevaform Type GS or approved equal.

D. Round branch take-off fittings for flexible duct:

1. Round duct branch take-off fitting shall be made of galvanized sheet metal designed for twist-in installation and to assure minimum air loss at the take-off. The fittings shall be of the conical converging type to reduce the pressure drop through the fittings. Provide a

raised bead on the throat of the fitting to assure a tight positive connection. Products shall be Flexmaster Model CB-DE-BO3 or approved equal.

2. Provide each fitting with the following:

   a. Lockable quadrant damper.
   b. 45-degree extractor scoop.
   c. Insulation guard where used with internally lined ductwork.

3. Provide these "spin-in" type fittings at all connections between rigid sheet metal duct and flexible duct at the upstream end of the flexible duct.

PART 3 - EXECUTION

3.1 GENERAL

A. All duct systems shall be free of noise, chatter, vibration and pulsation under all conditions of operation. Remove, replace or reinforce as directed by the Architect/Engineer if necessary to correct such conditions.

B. If field conditions are determined to exist which would limit the guarantee of air delivery or system performance, due notice in writing shall be submitted to the Architect/Engineer of such conditions prior to starting fabrication.

C. Properly support and align ductwork. Ducts to be free of sag and bulge. Hang ductwork below concrete floors or roof deck with hangers set prior to pouring concrete, or from self drilling screw anchors. GUN POWDER SET ANCHORS ARE NOT PERMITTED.

D. Where it is necessary that ducts be divided due to pipes or other obstructions which must pass through these ducts, the Contractor shall, at locations as noted or directed, provide air-stream deflectors in the duct and the duct shall be increased in size to maintain equivalent area around deflectors. Such changes shall be in accord with standard SMACNA details and shall be shown on Contractor's As-Built Drawings.

E. Interior of ductwork visible through registers, grilles, or diffusers shall be painted flat black.

F. Do not route ductwork through transformer vaults and electrical equipment spaces and enclosures.

G. Construct all ductwork and accessories in accord with the latest indicated editions of applicable SMACNA construction standards. Sheet Metal and Air Conditioning Contractors' National Association.

H. Streamline all ductwork to the full extent practical and equip with proper and adequate devices to assure proper balance and quiet draftless distribution of indicated air quantities.

I. Protect all ductwork and system accessories from damage during construction until Architect/Engineer's final acceptance of project.

J. Prior to ductwork fabrication, verify if all ductwork as dimensioned and generally shown will satisfactorily fit allocated spaces. Take precautions to avoid space interferences with beams, columns, joists, pipes, lights, conduit, other ducts, equipment, etc. Notify Architect/Engineer if any spatial conflicts exist, and then obtain Architect/Engineer's approval of necessary routing. Make any such necessary revisions which are minor at no additional cost.

K. Carefully correlate all duct connections to air handling units and fans to provide proper connections, elbows and bends which minimize noise and pressure drop.

L. Provide all curved elbows with radius ratios of not less than 1.5 unless otherwise shown or approved by Architect/Engineer. Provide all mitered elbows with turning vanes.

M. Properly suspend all ductwork so that no objectionable conditions result (such as vibration, sagging, etc.).

N. Coordinate any and all dimensions at interfaces of dissimilar type of ductwork and at interfaces of ductwork with equipment so that proper overlaps, interfaces, etc., of insulation and continuity of vapor barriers are maintained.

O. If necessary where ducts interface and have different types of insulation, provide transitions so that internal free-clear dimensions of duct remain unchanged.

P. Install horizontal low pressure ductwork at a level which maximizes length of any vertical, rectangular or round rigid duct connections to rectangular diffuser necks; however, such vertical duct connections are not required to be over 24 inches in length.

Q. Make connections from any low pressure ductwork to terminal units (fan terminal units, variable volume boxes, etc.) with appropriate lengths of flexible duct unless other type of connection is indicated.

R. Install all flexible round duct without kinks or similar obstructions so that pressure drop is minimized. Cut and remove excess lengths as necessary.

S. Install horizontal rigid ductwork as high as practical above suspended ceilings so that movable light fixtures may be relocated without interference to meet any future partition relocation requirements.

T. Insulated Duct: Where ducts will be insulated, make provision for neat insulation finish around damper operating quadrants, splitter adjusting clamps, access doors, and similar operating devices. A metal collar equivalent in depth to insulation thickness and of suitable size to which insulation may be finished shall be mounted on duct.

3.2 LOW PRESSURE SHEET METAL DUCTS

A. If width or height of rectangular duct exceeds 12 inches, cross break or roll a cross bead in panels to increase stiffness; otherwise, use two gages heavier steel.

B. Provide corner closures. Longitudinal seams and transverse joints shall be flat and smooth inside. Make slip joints in direction of air flow. See governing SMACNA manual for transition requirements.

C. Fabricate offsets, turns and elbows with centerline radius equal to 1-1/2 times diameter when possible. No mitered offsets will be allowed. Provide double thickness turning vanes to assist in smooth flow of air in square elbows or elbows with centerline radius less than duct width or diameter.

3.3 LOW PRESSURE FLEXIBLE DUCTS

A. Flexible ducts shall not be used unless specifically indicated on drawings.

B. If flexible duct is indicated for use on this project, it must comply with the following requirements.

1. The extent of the use of flexible ductwork shall be limited to that shown on the drawings.
2. Flexible duct installation shall be per SMACNA Flexible Duct Installation Standards, and manufacturers latest printed instructions, whichever is stricter. In addition the following shall apply:

   a. Flexible duct between rigid duct and diffusers shall be a MAXIMUM of 8 feet in length and shall be fully extended with a maximum equivalent of (2) 90 degree bends (no bend shall be made with centerline radius of less than one duct diameter). No additional flexible duct shall be provided for future terminal device relocation unless otherwise specified.
   b. Flexible duct shall be supported at ends and at each 90 degree bend. Maximum permissible sag is 1/2 inch per foot of spacing between supports.
   c. Hanger or saddle material in contact with the flexible duct shall be of sufficient width to prevent any restriction of the internal diameter of the duct when the weight of the supported section rests on the hanger or saddle material. In no case will the material contacting the flexible duct be less than 1 inch wide. Narrower hanger material may be used in conjunction with a sheet metal saddle which meets the foregoing specifications. This saddle must be formed to cover one-half the circumference of the outside diameter of the flexible duct and must be rolled to fit neatly around the lower half of the duct's outer circumference.
   d. Factory installed suspension systems integral to the flexible duct are an acceptable alternative hanging method when manufacturers recommended procedures are followed.
   e. Hangers shall be adequately attached to the building structure (not pipe, conduit, etc.).
   f. To prevent tearing of vapor barrier, do not support entire weight of flexible duct on any one hanger during installation. Avoid contact of flexible duct with sharp edges of hanger material. Damage to vapor barrier may be repaired with approved tape. If internal core is penetrated, replace flexible duct or treat as a connection.

3. Terminal devices connected by flexible duct shall be supported independently of the flexible duct.

3.4 MISCELLANEOUS DUCT SYSTEM COMPONENTS

A. Spin-In Take-Off Fittings: Install around duct branch takeoff fittings according to manufacturer's installation instruction. Additionally seal fitting to rectangular duct with a thin bead of mastic sealant.

3.5 HANGERS AND SUPPORTS

A. General: Comply with latest applicable SMACNA construction standard. Where sprayed fireproofing occurs, install hangers before application of such treatment and withhold installation of ducts until after application.

B. Supports: Vertical risers and other duct runs where the method of support specified above is not applicable shall be supported by substantial angle brackets designed to meet field conditions and installed to allow for duct expansion.

C. Fasteners: Secure hangers to steel beams or metal deck with beam clamps or drop through connections from the metal or concrete deck.

3.6 CHANGES IN SHAPE OR DIMENSION

A. Where duct size or shape is changed to effect a change in area, the following shall apply:

1. Where the area at the end of the transformation results in an increase in area over that at the beginning, the slope of the transformation shall not exceed one inch in seven inches.
2. Where the area at the end of the transformation results in a decrease in area from that at the beginning, the slope of the transformation may be one inch in four inches, but one inch in seven inches is preferable, space permitting.
3. The angle of transformation at connections to heating coils or other equipment shall not exceed thirty degrees from a line parallel to the air flow on the entering side of the equipment, nor fifteen degrees on the leaving side. The angle of approach may be increased to suit limited space conditions when the transformation is provided with vanes approved by the Architect/Engineer.

3.7 CHANGES IN DIRECTION

A. Changes in direction shall be basically as indicated on the drawings and the following shall apply:

1. Supply duct turns of ninety degrees in low pressure duct shall be made with mitered elbows fitted with closely spaced turning vanes designed for maintaining a constant velocity through the elbow.
2. Return and exhaust duct turns of ninety degrees in low pressure duct shall be made with mitered elbows, as specified hereinbefore for supply ducts, unless radius elbows are indicated in which case they shall be constructed with a turning radius one and one-half (1-1/2) times the width (with width considered as the dimension in the plane of the turn) as measured to the duct centerline.
3. Tees in low pressure duct shall conform to the design requirements specified hereinbefore for elbows.
4. Branch take-offs in low pressure supply duct shall be made with extractors or splitter dampers, as indicated, in square take-offs.
5. In high pressure duct, branch take-offs and connections to flexible duct supplying air to terminal units shall be made with conical taps.

3.8 IMPROPER MATERIALS OR CONFIGURATION

A. If ductwork materials or ductwork configurations are installed which do not meet these specifications, Contractor shall remove such ductwork and replace with materials or configurations which are acceptable. Any delay in job progress will be the responsibility of the Contractor.

3.9 OTHER REQUIREMENTS

A. Insulated Duct: Where ducts will be insulated, make provision for neat insulation finish around damper operating quadrants, splitter adjusting clamps, access doors, and similar operating devices. A metal collar equivalent in depth to insulation thickness and of suitable size to which insulation may be finished shall be mounted on duct.

B. Control Devices: Properly install all control related devices which are part of the duct systems. See Section(s) describing control systems.

3.10 SEALING OF DUCTS

A. Duct seal classes are as follows:

1. Seal class "A": Seal all transverse joints, longitudinal seams and duct wall penetrations. Use for P/VC-4 (4" w.g.) and greater unless otherwise indicated.
2. Seal class "B": Seal all transverse joints and longitudinal seams. Use for P/VC-3 (3" w.g.) unless otherwise indicated.
3. Seal class "C": Seal all transverse joints. Use for P/VC-2 (2" w.g.) and lower unless otherwise indicated.

B. Where sealing is required, it shall mean the following:

1. The use of adhesives, gaskets, tape systems or combinations thereof to close openings in the surface of the ductwork and field-erected plenums and casings through which air leakage would occur; or
2. The use of continuous welds;
3. The prudent selection and application of sealing methods by fabricators and installers, giving due consideration to the designated pressure class, pressure mode (positive or negative), chemical compatibility of the closure system, potential movement of mating parts, workmanship, amount and type of handling; cleanliness of surfaces, product shelf life, curing time and manufacturer-identified exposure limitations;
4. That these provisions are applicable to duct connections to equipment and to apparatus but are not for equipment and apparatus;
5. That where distinctions between seams and joints are made herein, a seam is defined as joining of two longitudinally (in the direction of air-flow) oriented edges of duct surface material occurring between two joints. Helical (spiral) lock seams are exempt from sealant requirements. All other duct surface connections made on the perimeter are deemed to be joints. Joints are inclusive of but not limited to girth joints; branch and sub-branch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum and casing abutments to building structures; that sealing requirements herein do not contain provisions to:

    a. Resist chemical attack.
    b. Be dielectrically isolated.
    c. Be waterproof, weatherproof or ultraviolet ray resistant.
    d. Withstand temperatures higher than 120^{o}F or lower than 40^{o}F.
    e. Contain atomic radiation or serve in other safety-related construction.
    f. Be electrically grounded.
    g. Maintain leakage integrity at pressures in excess of the duct classification herein.
    h. Be underground below the water table.
    i. Be submerged in liquid.
    j. Withstand continuous vibration visible to the naked eye.
    k. Be totally leak-free within an encapsulating vapor barrier.
    l. Create closure in portions of the building structure used as ducts, e.g., ceiling plenums, shafts, pressurized compartments.

6. The requirements to seal apply to both positive pressure and negative pressure of operation.

7. Externally insulated ducts located outside of buildings shall be sealed prior to being insulated as though they were inside. If metal surfaces of ducts located on the exterior of buildings are exposed to weather, they shall receive exterior duct sealant. An exterior duct sealant is defined as a sealant that is marketed specifically as forming a positive air and water tight seal, bonding well to the metal involved, remaining flexible with metal movement and having a service temperature range of -30°F to 175°F. If exposed to direct sunlight it shall also be ultraviolet ray and ozone resistant or shall, after curing, be painted with a compatible coating that provides such resistance. The term sealant herein is not limited to materials of adhesive or mastic nature but is inclusive of tapes and combinations of open weave fabric strips and mastics.

C. Materials and applications for sealing ducts:

1. General:

   a. Complete product data on all materials used for sealing ducts must be submitted for approval prior to any duct fabrication.
   b. All sealants must be specifically recommended by their manufacturer for the purpose of sealing ducts.

2. Liquid Sealant:

   a. Use only for slip type joints where sealant is to fill small space between overlapping pieces of metal. Do not use where metal clearances exceed 1/32-inch.
   b. Sealant must be specifically manufactured for the purpose of sealing ducts.

3. Mastics:

   a. Use in lieu of liquid sealant at Contractor's option.
   b. Use as a fillet, in grooves and between flanges.
   c. Do not use oil base caulking or glazing compounds.

4. Gaskets:

   a. Use soft elastomer butyl or neoprene rubber or extruded forms of sealants in flanged joints in addition to mastic.

5. Tape:

   a. Tape is not allowed on sheet metal ducts.

6. Combination of mastic and embedded fabric:

   a. Use mastic/mesh/mastic as a sealant where pressure/velocity classification equals and exceeds P/VC-3 and where any spaces between metal surfaces at transverse joints or longitudinal seams or duct wall penetrations exceeds 1/16-inch.
   b. Apply glove coat of mastic, then embed a continuous or overlapping strip of not less than 4-inch wide 10 x 10 fiberglass cloth into the mastic, then apply a final glove coat of mastic over the glass cloth.

7. Surface preparation:

   a. Surfaces to receive sealant should be adequately clean (free from oil, dust, dirt, rust, moisture, ice crystals and other substances that inhibit or prevent bonding). Use

solvent and/or apply a face primer if necessary to obtain adequately clean surface for adhesion.

3.11 LEAKAGE TESTING

A. General:

1. Test the following duct systems:

   a. All ducts which are (1) under positive or negative pressure and (2) which are directly connected to air moving device (air handling unit, exhaust fan, supply fan or similar air moving equipment) and (3) which convey 1000-cfm or greater through their largest portion.
   b. All ducts which are (1) under positive or negative pressure and (2) which are part of a supply, return, outside and/or exhaust air system and (3) which are equal to or greater than 25 feet in length and (4) which may or may not be directly connected to an air moving device.

2. Portions of duct to be tested shall consist of all portions from the largest cross sectional area to the air distribution device connection or to the smallest inlet or outlet point, whichever is applicable.
3. Duct systems shall be constructed so that leakage does not exceed 5.00% of the air quantity handled by the respective fan.

B. Allowable Leakage:

1. Leakage shall be measured during leakage test at a test pressure which is equal to the pressure/velocity classification of the duct system (e.g., a P/VC-2 duct shall be tested at 2.0 in. w.g.s.p., a P/VC-1/2 duct at 0.5 in. w.g.s.p., etc.).

C. Test Procedure:

1. Test at time of duct installation and prior to installation of any field applied insulation and prior to any concealment in chases or similar enclosures.
2. Duct openings (both entry openings and outlet openings) shall be capped or sealed by taping or banding a flexible plastic sheet over each opening prior to pressurizing duct. The plastic sheet shall be of adequate strength and thickness to withstand the test pressures. Use other method of sealing duct openings providing objective of test is obtained and if method of sealing is approved by Architect/Engineer.
3. Use a fan having a minimum capacity of 300-cfm or 5% of the particular duct system design capacity, whichever is greater and which is capable of producing a duct test pressure of 150% of the duct test pressure.
4. Test fan shall be connected to a flow measuring assembly consisting of straightening vanes and an orifice plate mounted in a straight tube with appropriately located pressure taps. Orifice assembly shall be accurately calibrated with its own calibration curve. Pressures shall be measured with U-tube manometers and corresponding flow rates obtained from the orifice performance curve.
5. Connect test fan and orifice flow measuring assembly to the duct to be tested with a section of flexible duct.
6. Test for audible leaks as follows:

   a. Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.

b. Start the blower with its control damper closed (some small blowers popularly used for testing ducts may damage the duct because they can develop pressures up to 25 inches (W.G.).
c. Gradually open the inlet damper until the duct pressure reaches 50% in excess of designed duct operating pressure.
d. Survey all joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealing has been repaired if and where necessary.

7. After all audible leaks have been sealed, the leakage should be measured with the orifice section of the test apparatus as follows:

   a. Start blower and open damper until pressure in duct reaches 25% in excess of designed duct operating pressure.
   b. Total allowable leakage shall not exceed five (5) percent of the total system design air flow rate. When partial sections (such as supply section, return section, etc.) of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.

8. Correct any duct leaks which are detected either audibly or by touch regardless of whether leakage through duct system is less than allowable test leakage.

3.12 DEFINITIONS OF DUCT TYPES

A. Refer to the "Duct Construction Schedule" on the Drawings for:

1. The type of ductwork and where it is to be installed.
2. The pressure/velocity class at each location.
3. Indication of whether the ductwork is to be insulated externally or internally lined or not insulated.

END OF SECTION 23 31 00

SECTION 23 33 00
DUCT SYSTEM ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide all necessary duct system accessories to assure proper balance, quiet and draftless distribution and conveyance, and minimization of turbulence, noise and pressure drop for all supply return, exhaust and ventilation air quantities indicated.

B. Items Included: This section generally includes, but is not limited to, the following items as may be applicable to this project:

1. Flexible duct connections.
2. Splitters.
3. Turning vanes.
4. Manual volume dampers.
5. Access doors.
6. Fire dampers.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Ductwork.
2. Air distribution devices.
3. All types of air handling equipment.

1.4 COORDINATION

A. Coordinate all items affecting the duct systems including but not limited to the following items: air handling units, exhaust fans, supply fans, sound attenuators, duct mounted coils, access panels air distribution devices, fire dampers, outside air louvers, hoods, filters, roof curbs, structural framing, roof construction, roofing, and the work of all trades to insure an orderly and timely progression of the work.

1.5 SHOP DRAWINGS

A. Include complete data on: access doors; flexible connectors; manual volume dampers including operating hardware; extractors; turning vanes; automatic shutters and all other items.

B. See section entitled, "General Mechanical Provisions".

1.6 OTHER REQUIREMENTS

A. Provide all components in accordance with manufacturer's recommendations.

B. All ductwork dimensions indicated which may affect items of this section are nominal free clearance internal dimensions which do not include insulation thickness.

1.7 DEFINITIONS

A. "SMACNA" means "Sheet Metal and Air Conditioning Contractors National Association, Inc.".

PART 2 - PRODUCTS

2.1 GENERAL

A. Be recommended by the manufacturer for the application.

B. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Ventfabrics
2. Barber-Colman
3. Tuttle & Bailey
4. Dura-Dyne
5. Airsan
6. Titus
7. Anemostat
8. Young
9. Metalaire
10. United McGill

C. Products which are specified may not necessarily all be required on the projects; provide those products which are applicable.

2.2 FLEXIBLE DUCT CONNECTIONS

A. Provided where air handlers, fans and blowers connect to their ductwork.

B. At least 4 inches long.

C. Connected on each side to metal (either metal ductwork, air handling apparatus, or heavy gauge steel sleeves).

D. For use in high and/or low pressure duct systems.

E. Ventfabrics, Inc., "Ventglas Metaledge", or equivalent.

2.3 SPLITTERS

A. Provide for adjustment of air volume to their respective branches, where indicated. Constructed of at least the same gauge galvanized steel as the duct wherein they are used, and in no instance be less than twenty-two (22) US gauge. Use in low pressure duct systems only. Be adequately sized to close off air to applicable branches. Rigidly attached to pivot rod and operating linkage. Install on raised insulated base when used in internally insulated ductwork. Splitter blades; formed in two thicknesses of metal so that entering edge presents rounded nose to air flow; length no less than one and one half times the width of the smaller branch served or twelve inches, whichever is larger. Hardware used for the construction, assembly, and operation of splitter dampers shall be as follows:

1. Operators for exposed splitters and those located above "lay-in" or accessible ceiling shall be Ventlok #690 splitter damper assembly.
2. Operators for concealed splitters shall be Ventlok #691 with #680 miter and #677 concealed regulator.

2.4 LOW PRESSURE METAL TURNING VANES

A. Provide in all elbows, bends and tees of all low velocity supply air ducts whether or not shown in detail; provide in all elbows, bends and tees of all other low velocity ducts where portions of such ducts convey air at greater than 700 fpm average velocity. Adequate rigidity and strength to be completely flutterproof; properly designed; permanently fixed type. Aluminum, or steel with acid/solvent chemical corrosion resistant coating, or galvanized steel. Air foil type in all mitered elbows, mitered bends and tees. Air foil type must be manufactured by Titus, Tuttle & Bailey, Anemostat, Waterloo, Metalaire, Barber-Colman or other approved manufacturer. Be Barber-Colman "Airturns", Tuttle and Bailey "Ducturns", or Dura-Dyne "VR" with 24 gauge rails and hollow vanes, or equivalent.

2.5 HIGH PRESSURE TURNING VANES

A. None required for this project.

2.6 MANUAL VOLUME DAMPERS

A. These dampers are to be other than those specified as being integral with each register, diffuser and other air outlet or inlet.

B. Provided where indicated in the complete air distribution system(s) (including ductwork, return air plenums, etc.) to allow complete balancing of the air supply, return, ventilation and exhaust system(s).

C. Opposed blade type.

D. 8" maximum blade width.

E. Made of galvanized steel, steel with acid/solvent chemical resistant coating, or steel with a sprayed or dipped aluminum rust resistant finish; flutterproof.

F. Provided so that all damper adjustment can be made from outside the completed ductwork without necessity for puncturing or otherwise penetrating the ductwork and/or its vapor barrier.

G. Fully adjustable and with locking device.

H. Manufactured by Titus, Tuttle & Bailey, Anemostat, Waterloo, Metalaire, Greenheck or equivalent.

I. Provided at a point in the ductwork which is a sufficient distance upstream from an outlet (or downstream from an inlet) to attenuate objectionable noise due to damper throttling and to preclude adverse effects on the distribution device.

J. Based upon location of the duct in which the damper is to be installed, provide the following types:

1. Dampers in ducts which are exposed or located above "lay-in" or "accessible ceilings": Young Regulator Company Model 817 or equivalent.
2. Dampers in ducts concealed above plaster ceilings or behind dry wall construction: Young Regulator Company Model 817A or equivalent.

K. Use in low pressure duct system only.

2.7 LOW PRESSURE DUCT ACCESS DOORS

A. Provided for: each manual and motorized damper; fire damper; smoke damper; electric duct heater; and where access is otherwise necessary.

B. Factory prefabricated double wall insulated type of 24 US gauge galvanized steel (of same or thicker gauge than ductwork panel in which installed, whichever is greater).

C. Minimum size shall be as large as is compatible with duct size but in no case less than the following (provide larger sizes if necessary to permit proper access operation):

Max. Duct Dimensions	Access Door Size
11" and less	10" x 12"
12" through 16"	12" x 16"
17" and over	16" x 24"

D. Doors shall be provided with and operated adjustable tension catches and shall be completely gasketed around their perimeters. Doors shall be Ventlok "Access Doors". Install in accordance with manufacturers recommendations using Ventlok #360 sealant or equivalent.

2.8 TEST OPENINGS

A. Furnish and install gasketed capped test openings for test equipment (pitot tubes, etc.) on the entering and leaving sides of air handling unit and other air handling equipment and heating coils. Test openings shall be Ventlok #699-2 or equivalent.

2.9 PREFABRICATED DUCT CONNECTIONS

A. At Contractor's option, prefabricated duct connections as manufactured by Ductmate (or approved equal system) may be used in locations and applications for which the duct connection system is recommended. Use of these connections must meet or exceed specified duct construction quality as related to structural rigidity, pressure, accessibility and other such requirements.

2.10 FIRE DAMPERS

A. Rating: 1-1/2 hours (UL approved for installation in 2 hour walls).

B. Construction: Minimum 24 gauge galvanized steel frame suitable for connection to ductwork without transition, minimum 24 gauge galvanized steel curtain type blades located out of the airstream, thickness coordinated with wall construction. Where an active smoke control system exists (refer to Section 23 09 93) the damper shall be capable of closing in an airstream moving at a minimum of 2000 feet per minute and operating at 4" w.g. pressure (dynamic damper).

C. Sleeves: UL listed minimum gauge galvanized steel with welded construction corners. Rollformed sleeves will not be acceptable unless contractor guarantees in writing to seal voids in sleeve with UL approved sealer to limit air leakage. Length of sleeve shall be coordinated with the wall or floor.

D. Operation: Stainless steel constant force closure spring.

E. Link Setting: 160°F or 165°F.

F. Based on Ruskin Manufacturing Co. IBD2 Style B. (Static Systems).

G. Based on Ruskin Manufacturing Co., DIBD2 Style B. (Active smoke control systems only).

2.11 BACKDRAFT DAMPERS

A. Low Pressure Ductwork:

1. Rating: Up to 1" wg positive or negative.
2. Frame: Minimum 16 gauge (.064") galvanized steel or extruded aluminum.
3. Blades: Minimum 16 gauge (.064") galvanized steel or extruded aluminum parallel blade action, brass bearing, non-ferrous or de-iron pivot pins, gasketed blades.
4. Accessories: Counter balance and weights suitable for assisting or retarding as indicated on the drawings.
5. Based on Ruskin Manufacturing, Co. CBD4.

PART 3 - EXECUTION

3.1 GENERAL

A. Construct and install all accessories in accordance with the latest indicated editions of applicable SMACNA construction standards.

B. Provide all mitered elbows with turning vanes.

C. Install all duct system accessories in accordance with manufacturer's recommendations.

D. All accessories installed in poly-vinyl-steel ductwork shall have acid/solvent chemical corrosion resistant coating.

E. All manual damper arms shall be tagged with fluorescent colored strip.

3.2 FIRE DAMPERS

A. Fire dampers shall be provided where indicated.

B. Review the architectural drawings to determine the wall construction rating so as to provide the proper rated damper.

C. All fire dampers shall be mounted within a UL approved thickness galvanized steel sleeve permanently affixed to the wall by means of perimeter retaining angles.

D. The fire damper shall be permanently attached to the sleeve. All voids around the sleeve and damper and sleeve and wall shall be properly sealed with fire barrier material, refer to division 07.

E. Ductwork shall be attached to the fire damper by means of a UL approved break away connection.

F. Access doors or access sections shall be provided at all fire damper locations.

3.3 BACKDRAFT DAMPER

A. Securely attach backdraft damper to wall with a suitable sleeve and retaining angles and seal all voids between damper and wall.

B. Adjust damper to open or close under the design conditions.

END OF SECTION 23 33 00

SECTION 23 33 19
SOUND ATTENUATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide factory fabricated sound attenuators of the types, sizes, and acoustical and airflow characteristics indicated.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

A. Refer to requirements of Section entitled "General Mechanical Provisions". Include complete data on: dimensions, airside pressure losses, dynamic insertion losses, regenerated sound level (i.e. self-noise or airflow generated noise), performance certification, performance test method, and materials of construction.

1.5 MANUFACTURER

A. Products listed in this Section or on the plans are based on specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Rink Division of Krueger/Phillips Industries
2. Commercial Acoustics
3. Transonics
4. Industrial Noise Control, Inc.
5. Titus
6. United McGill Corporation

PART 2 - PRODUCTS

2.1 OUTER CASINGS

A. The outer casings of the attenuators shall be constructed of not less than 22 gauge galvanized steel with seams lock formed and mastic filled, or shall be continuously welded.

2.2 PARTITIONS

A. The interior partitions of the attenuators shall be constructed of not less than 24 gauge galvanized perforated steel.

2.3 FILLER MATERIALS

A. The silencer filler material shall be inorganic mineral glass fiber of a density sufficient to obtain the specified acoustic performance and shall be packed at not less than five percent (5%) compression to prevent the formation of voids due to vibration or settling. The material shall be inert, vermin and moisture proof, and shall comply with the flame spread and smoke developed ratings of NFPA 90A.

2.4 PERFORMANCE

A. Acoustic and aerodynamic performance shall be tested and certified in accordance with ASTM E477-84 Standard Method of Testing Duct Liner Material and Prefabricated Silencers for Acoustical and Airflow Performance. Airflow pressure drops shall be tested in accordance with AMCA Standards. The performance indicated is not a band-by-band listing of the silencer scheduled, but reflects actual minimum attenuation (in decibels) for the indicated octave bands at the design conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Refer to manufacturer's instructions and the requirements of Section entitled "Ductwork" for installation and supporting requirements.

B. Where multiple sound attenuators are assembled, by either the manufacturer or the installer, into attenuator banks, the individual attenuators shall be securely fastened together using galvanized steel bands, straps, structural angles and/or welds, as recommended by the manufacturer. All joints between the assembled attenuators shall be sealed to prevent air leakage as recommended by the manufacturer.

3.2 COORDINATION

A. Coordinate with sizes of ducts to be connected to attenuators. Provide duct transitions to match sizes of attenuators and attenuator banks if duct sizes differ from sizes of attenuators and attenuator banks furnished.

END OF SECTION 23 33 19

SECTION 23 34 25
FANS: IN-LINE CENTRIFUGAL, LIGHT DUTY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide in-line centrifugal light duty exhaust fans of size, sound power level, and electrical characteristics indicated on drawings.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

A. Refer to requirements of Section entitled "General Mechanical Provisions". Include complete data on: fan external static pressure, fan rpm, motor rpm, fan tip speed, fan size, fan performance tables or curves showing all possible operating selection points for each fan size (including rating certification), fan brake horsepower, motor horsepower and electrical characteristics sound level, fan accessories, and a complete schedule worked up by fan number.

B. Exhaust air fans shall be AMCA certified as to both sound and performance ratings.

1.5 MANUFACTURER

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Acme Engineering and Manufacturing Company
2. Greenheck Fan and Ventilator Corp.
3. Ilg Industries, Inc.
4. Powerline, Inc.
5. Penn Ventilator Company
6. Loren Cook Company
7. Jenn Air
8. Carnes
9. Captive Aire

PART 2 - PRODUCTS

2.1 FAN HOUSING

A. Fan housing including longitudinal, traverse, and diagonal stiffeners, motor mounts, bearing and drive supports shall be constructed of steel. Entire fan housing shall be internally lined with 1/2-inch or greater, three pound per cubic foot density fiberglass acoustical duct liner with a stabilized surface. Liner shall be held in place with adhesive and mechanical fasteners. All insulation and adhesives shall meet requirements of NFPA 90A as to flame spread and smoke developed ratings. Housing, including all bracing, stiffeners and motor mounting assembly shall be factory finished with a baked on alkyd enamel finish over a corrosion resistant primer. Removable panel in bottom of housing for complete access to motor and fan. Inlet and outlet duct connections.

2.2 FAN WHEEL

A. Shall be centrifugal type and shall be statically and dynamically balanced.

2.3 FAN MOTOR

A. Permanently lubricated shaded pole motor mounted on resilient isolators to minimize vibration and noise.

2.4 BACKDRAFT DAMPER

A. Mounted in throat of fan discharge.

2.5 DRIVE ASSEMBLY

A. Drive shall be direct drive type as indicated on drawings, and shall conform with the requirements of Section entitled "General Mechanical Provisions".

2.6 DISCONNECT SWITCH

A. Fans shall include factory mounted disconnect switches prewired to the drive motor.

2.7 SPEED CONTROL

A. Solid state speed controller for speed reduction to 40%. Mounted on housing or as otherwise indicated.

PART 3 - EXECUTION

3.1 FAN PLACEMENT AND MOUNTING

A. Fan locations shall be essentially as shown on drawings; however, actual wall openings and fan placement shall be verified using field measurements and data relating to equipment approved for actual installation on this project. Mount fan in strict accordance with manufacturer's instructions.

3.2 SOUND AND VIBRATION CONTROL

A. Refer to Section entitled "Ductwork" for air side sound control and to Section entitled "Vibration Isolation" for vibration control.

3.3 DUCT CONNECTIONS

A. Inlet and discharge ducts shall be connected to the fan duct collars using flexible connectors. These connectors shall be installed properly so that they are not in tension and are aligned with their respective ducts.

3.4 TEST AND BALANCE

A. All fan performance shall be certified as specified in section describing test and balance procedures.

3.5 OTHER REQUIREMENTS

A. Remove shipping bolts and temporary supports within fans. Adjust dampers for free operation.

B. Provide necessary anchorage and supports to prevent vibration.

END OF SECTION 23 34 25

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SECTION 23 34 29
FANS: CENTRIFUGAL, CEILING MOUNTED

PART 1 - GENERAL

1.1 SCOPE

A. Provide ceiling mounted light duty centrifugal fans with characteristics indicated.

1.2 SHOP DRAWINGS

A. Refer to requirements of Section entitled "General Mechanical Provisions".

1.3 CERTIFIED PERFORMANCE

A. Be AMCA certified as to both sound and performance ratings.

1.4 MANUFACTURER

A. Design Basis: Basis of design is similar to Acme Master-ette Model V Series and Greenheck CSP Series or as scheduled on drawings.

B. Acceptable Manufacturers: Greenheck Fan and Ventilator Corporation; Ilg Industries, Inc.; Powerline, Inc.; Power Ventilator Company, Loren Cook Company; Acme Engineering and Manufacturing Corporation; Penn Ventilator Company, Captive Aire or equal.

PART 2 - PRODUCTS

2.1 FAN HOUSING

A. Fan housing including longitudinal, traverse, and diagonal stiffeners, motor mounts, bearing and drive supports shall be constructed of steel. Entire fan housing shall be internally lined with ½-inch thick or greater, three pound per cubic foot density fiberglass acoustical duct liner with a stabilized surface. Liner shall be held in place with adhesive and mechanical fasteners. All insulation and adhesives shall meet requirements of NFPA 90A as to flame spread and smoke developed ratings. Housing, including all bracing, stiffeners and motor mounted assembly shall be factory finished with a baked on alkyd enamel finish over a corrosion resistant primer. Removable panel in bottom of housing for complete access to motor and fan.

2.2 CEILING INLET GRILLE

A. Steel or aluminum: Baked enamel finish.

2.3 FAN WHEEL

A. Shall be centrifugal type and shall be statically and dynamically balanced. Single or twin impeller as necessary to provide indicated performance.

2.4 FAN MOTOR

A. Permanently lubricated shaded pole motor mounted on resilient isolators to minimize vibration and noise.

2.5 BACK DAMPER

A. Mounted in throat of fan discharge.

2.6 DRIVE ASSEMBLY

A. Drive shall be direct drive type as indicated on drawings, and shall conform with the requirements of Section entitled "General Mechanical Provisions".

2.7 DISCONNECT SWITCH

A. Fans shall include factory mounted disconnect switches prewired to the drive motor.

2.8 SPEED CONTROL

A. Solid state speed controller for speed reduction to 40% Mounted on housing or as otherwise indicated.

PART 3 - EXECUTION

3.1 PLACEMENT AND MOUNTING

A. Fan locations shall be essentially as shown on drawings; however, actual fan placement shall be verified using field measurements and data relating to equipment approved for actual installation on this project. Mount fan in strict accordance with manufacturer's instructions.

3.2 TEST AND BALANCE

A. All fan performance shall be certified by test and balance procedures as specified in section describing test and balance procedures.

END OF SECTION 23 34 29

SECTION 23 36 16
TERMINAL UNITS: VAV, SINGLE INLET, ELECTRIC COIL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Shutoff, single-duct air terminal units.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

1.6 NOISE CRITERIA

A. Unless otherwise indicated on drawings, the following noise criteria comprise the basis upon which the selected terminal units must be rated in order to comply with the design limits for allowable NC levels:

1. All sound power level decibels are referenced to 10 to the minus 12 watts.
2. Room outlet NC sound pressure levels specified for these TUs are based on 10db room absorption.
3. Room radiated NC sound pressure levels specified for these TUs are based on 10db room absorption plus 13 NC ceiling sound transmission loss.

4. The maximum allowable NC level in any occupied space (unless otherwise indicated) shall not exceed NC35 as a result of radiated or discharge noise from any terminal unit.
5. NC levels which are generated by the terminal units on which noise criteria will be judged are those NC levels generated when the terminal unit is operating with an inlet static pressure of 1.0-inch w.g.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

2.2 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Environmental Technologies, Inc.
2. METALAIRE, Inc.
3. Nailor Industries Inc.
4. Price Industries.
5. Titus.
6. Trane; a business of American Standard Companies.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.034-inch steel, single wall.

1. Casing Lining: Adhesive attached, 1-inch- thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections, size matching inlet size.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
2. Damper Position: Normally open.

E. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized steel housing; with primary automatic and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.

1. Access door interlocked disconnect switch.
2. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
3. Nickel chrome 80/20 heating elements.
4. Airflow switch for proof of airflow.
5. Fuses in terminal box for overcurrent protection.
6. Mercury contactors.
7. Magnetic contactor for each step of control (for three-phase coils).

F. Direct Digital Controls: Bidirectional damper operators and microprocessor-based controller and room sensor. Control devices shall be compatible with temperature controls specified in Section 23 09 23 "Direct Digital Control System" and shall have the following features:

1. Damper Actuator: 24 V, powered closed, powered open.
2. Terminal Unit Controller: Pressure-independent, variable-air-volume controller with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes, and having the following features:

    a. Occupied and unoccupied operating mode, as indicated on plans.
    b. Remote reset of airflow or temperature set points.
    c. Adjusting and monitoring with portable terminal.
    d. Communication with temperature-control system specified in Section 23 09 23 "Direct Digital Control System."

3. Room Sensor: Wall mounted, with temperature set-point adjustment and access for connection of portable operator terminal.

2.3 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Steel Cables: Galvanized steel complying with ASTM A 603.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to ARI 880.

1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
3. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

A. Install piping adjacent to air terminal unit to allow service and maintenance.

B. Make connections to air terminal units with flexible connectors.

3.4 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Air terminal unit will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 23 36 16

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SECTION 23 37 13
AIR DISTRIBUTION DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide all air distribution devices as indicated on the drawings and as specified herein for a complete and operable system.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

B. Coordinate with work of the ceiling, drywall and plastering trades as required to insure an orderly progression of work and a first class finished system with respect to placement, alignment, finish, general fit and absence of conflict with lighting systems and fire protection systems.

Insulate air distribution devices to prevent condensation formation.

1.4 DESIGN CONDITIONS

A. Acoustical: Noise produced at each diffuser, register, grille or other air distribution device shall not exceed a noise criteria level of NC 35 based on sound pressure levels in db re 0.002 microbars unless otherwise indicated. Coordinate air distribution devices, sound attenuation measures and equipment actually provided to insure that this design constraint is not exceeded by the system installed.

Exceptions: Any particular rooms or areas which are normally occupied by other than maintenance staff or service staff and which may be noted on the drawings as requiring lower NC criteria.

B. Pressure Drop: Pressure drop across any air distribution device shall not exceed 0.15 in wg static pressure unless otherwise indicated.

1.5 SHOP DRAWINGS

A. Refer to the requirements of Section entitled "General Mechanical Provisions".

1.6 MANUFACTURER

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Titus
2. Metalaire
3. Price
4. Krueger
5. Carnes

B. Manufacturers must be members of the Air Distribution Council unless otherwise indicated.

1.7 OTHER REQUIREMENTS

A. All aluminum is to be extruded unless otherwise indicated.

B. Appearance: Each air distribution device which has a portion thereof (frame, core, etc.) exposed to view in the finished area shall have a factory applied finish which matches and is compatible with the color of the surrounding surface on which the device is installed. Colors must be approved by Architect prior to device fabrication.

C. All louvers, dampers and/or shutters shall be rated by their manufacturer in accord with AMCA Standard 500-74.

D. Integral Components: All dampers, blank-off baffles and other companion devices which form an integral part of air distribution device shall be factory made items produced by the manufacturer of air distribution device.

E. Louvers: Louvers may be specified in another division but for reference may also be indicated on mechanical drawings.

F. Door Grilles: Door grilles may be specified in another division but for reference may also be indicated on mechanical drawings.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide the following air distribution devices as applicable to this project. Refer to air distribution device schedule as shown on drawings.

2.2 OTHER REQUIREMENTS

A. All devices must each comply with the applicable portions of the Air Diffusion Council (ADC) Equipment Test Code 1062R4 "Certification, Rating and Test Manual", the Air Movement and Control Association, Inc. (AMCA) Standard 500 "Test Method for Louvers, Dampers and Shutters" and the "National Fire Protection Association" (NFPA) Standard 90A "Installation of Air Conditioning and Ventilating Systems".

B. Provide ceiling and/or linear diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of diffuser.

C. Diffusers, grilles and registers installed in fire rated ceiling, or floor/ceiling assemblies shall be constructed of steel.

D. Mounting Screws: Where grilles, diffusers or registers are specified which require mounting screws visible from the face of the device these screws shall be furnished with the air distribution equipment and be finished at the factory to match the finish on the grille, diffuser or register in which they are to be used.

PART 3 - EXECUTION

3.1 GENERAL

A. Install neatly where indicated in accord with manufacturer's recommendations and in accord with SMACNA recommendations and as otherwise indicated.

B. Properly test, balance and adjust to produce quiet, draftless operation to best degree possible.

3.2 INSTALLATION

A. Rectangular Diffusers: Where diffusers are the lay-in type, they shall be supported by the inverted T-bar suspension system but all ducts connected thereto shall be supported independently of the ceiling as specified under Section entitled "Ductwork". Surface mounted diffusers shall be supported by the duct runouts or drops where sheet metal ducts are indicated and by separate hangers where flex runouts are indicated. All rectangular ceiling diffusers shall be installed with their lines parallel and perpendicular to the building line and properly aligned with the ceiling.

B. Sidewall Grilles and Registers: Mount securely to the duct system flanges using finish screws and in accordance with accepted good practice.

C. Ceiling mounted Exhaust and Return Registers/Grilles: Mount as specified hereinbefore for surface mounted ceiling diffusers except use finished screws provided and secure to duct and finished ceiling (or finished ceiling for nonducted returns) in accordance with the manufacturer's instructions. Where required to provide adequate support for nonducted registers or grilles, provide appropriate mounting frame for incorporation into the ceiling system.

D. Install all outlets and inlets as recommended by the manufacturer; in accordance with recognized industry practices; to insure that products serve intended functions.

E. Locate ceiling air outlets and inlets as indicated on the drawings. Unless otherwise indicated, locate units in center of acoustical ceiling modules. Install square and parallel with partitions, ceiling grid members, etc.

F. Spare Parts: Furnish to Owner, with receipt, 3 operating keys for each type of outlet and inlet that require them.

G. Do not install blank-offs under continuous linear diffuser distribution plenums. Distribution plenums shall cover only active portion of the diffuser.

3.3 PROTECTION OF WORK UNTIL FINAL ACCEPTANCE

A. Coordinate the installation of the air distribution equipment with related work and finishing of adjacent surfaces to prevent damage to the devices or adjacent finishes. Protect the finish of all air distribution equipment until final acceptance. Replace or repair to the Architect's satisfaction any damaged equipment.

END OF SECTION 23 37 13

SECTION 23 37 24
ROOF AIR INTAKES AND RELIEF VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide factory assembled roof air intake(s) and relief vent(s) where indicated. Sizes and operating characteristics shall be as scheduled on drawings or as otherwise indicated.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

A. Refer to requirements of Section entitled "General Mechanical Provisions". Include complete data on sizes; required clearances; direction of air flow; construction and dimensions; and capacities, static pressure losses, free areas and other operating characteristics.

1.5 MANUFACTURERS

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Acme
2. Ilg
3. Cook
4. Jenn-Air
5. Penn
6. Carnes
7. Greenheck
8. Powerline

PART 2 - PRODUCTS

2.1 GENERAL

A. Sized as indicated.

B. Low silhouette type.

C. Rain-tight under all operating conditions.

D. Constructed of any of the following materials: all fiberglass, spun or extruded aluminum, galvanized steel.

E. Pass indicated air quantities at not greater than 0.05 inches w.g. total pressure or as scheduled and, for intakes only, 500 fpm maximum throat and perimeter velocity.

F. 1/4" Mesh galvanized steel or PVC coated bird screen. Provided with parallel or opposed blade volume dampers and/or backdraft dampers where indicated.

G. Hood and curb assembly shall meet the wind load requirements of the Florida Building Code.

PART 3 - EXECUTION

3.1 PLACEMENT AND MOUNTING

A. Location shall be essentially as shown on the drawings, however, actual placement of the roof curb shall be verified using field measurements and data relating to the equipment approved for actual installation on this project. Mount items in strict accord with manufacturer's instructions. Permanently secure to roof curbs.

3.2 DUCT CONNECTIONS

A. Connect ducts (where required) to roof curb inlet flanges using flexible connectors. Install connectors properly so that they are not in tension and are aligned with ductwork.

3.3 TEST AND BALANCE

A. Unless specified otherwise and prior to requesting final inspection, operate equipment and adjust to achieve design air flow.

END OF SECTION 23 37 24

SECTION 23 37 25
LOUVERS

PART 1 - GENERAL

1.1 SCOPE

A. Provide complete louver assemblies as indicated on Drawings and in Specifications.

1.2 SHOP DRAWINGS

A. Refer to the section entitled "General Mechanical Provisions".

1.3 CERTIFICATION

A. All performance shall be certified by AMCA and bear the AMCA Certified Ratings Seal for Air Performance and Water Penetration in accord with AMCA Standard 550.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Stationary type; extruded aluminum construction.

B. All components factory assembled by the louver manufacturer including heads, jambs, sills, blades and mullions. Louver sizes too large for shipping shall be assembled at the site from factory assembled louver sections to provide the overall sizes required.

C. Frame:

1. 4-inch depth.
2. Suitable for mounting in the type of wall where indicated. Coordinate with wall construction indicated on architectural drawings.
3. Extruded aluminum of 0.100-inches minimum thickness.
4. Provided with caulking slots.

D. Blades:

1. Drainable type with drain gutter in each blade and downspouts in jambs and mullions.
2. Extruded aluminum of 0.081-inch minimum thickness.
3. Approximately 37-1/2-degree blade angle.
4. Blades on approximately 3-inch centers.

E. Finish:

1. Clear anodized.

F. Operating characteristics:

1. High free area.
2. Low water penetration.
3. Free area based on air velocity of not greater than 500 fpm.
4. Air flow pressure drop in intake mode or exhaust mode of not greater than 0.025-inches w.g.s.p.

G. Design: Limit span between visible mullions to 10-feet and shall incorporate such other structural supports required to withstand a wind load of 50 lbs. per sq. ft.

H. Size: As scheduled or shown on Drawings or as required to comply with the above operating characteristic constraints.

2.2 ACCESSORIES

A. Bird screen: Aluminum, 3/4-inch mesh, typical for all louvers.

B. Insect screen: Aluminum, 18-16 mesh, where indicated on drawings.

C. Frame: Flange, 1-1/2-inch nominal width for louvers of sizes 24" wide X 12" high and smaller; non-flanged, suitable for cased opening mounting for louvers of sizes greater than 24" wide x 12" high.

2.3 ACCEPTABLE MANUFACTURERS

A. Basis of Design: Ruskin Model ELF-6375DXD. Acceptable: equivalent products of American Warming & Ventilating; Carnes; Greenheck; Krueger; Louvers & Dampers, Inc., Metal Industries; or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Install in accord with manufacturer's recommendations and in accord with applicable portions of current SMACNA guidelines.

B. Installation shall be watertight between complete circumference of frame and wall.

C. Coordinate complete installation with other work related to structure, wall construction, ductwork (if any) and other such interfaces.

D. For additional requirements, refer to Architectural drawings and other portions of the Contract Documents.

END OF SECTION 23 37 25

SECTION 23 38 13
HOOD ASSEMBLY: KITCHEN EXHAUST, DOUBLE WALL

PART 1 - GENERAL

1.1 SCOPE

A. Provide factory pre-engineered kitchen supply/exhaust hood assembly(s) of the types, sizes and capacities indicated on the Drawings.

1.2 RELATION TO OTHER WORK

A. Refer to the section entitled "General Mechanical Provisions" for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Include complete performance data at the scheduled operating conditions; dimensions; weights; airside pressure losses; description of all components; wiring diagrams for all systems including internal power, control, and fire suppression/alarm systems.

1.5 CERTIFICATION AND COMPLIANCE

A. Entire hood system shall comply with applicable portions of NFPA Bulletin #96 and National Sanitation Foundation.

B. Wiring systems and light systems shall comply with the current National Electrical Code.

C. Filter system shall be U.L. listed.

1.6 DESIGN BASIS

A. Basis of design is similar to Greenheck "CircuVent" Series.

1.7 MANUFACTURERS

A. Acceptable manufacturers are: Greenheck, Greasemaster, Duo-Aire, Captive-Aire, Econovent, Gaylord, Accurex or equal.

PART 2 - PRODUCTS

2.1 GENERAL

A. Each hood assembly shall be:

1. Coordinated to be of proper size and dimensions to accommodate the exhaust requirements of the actual kitchen equipment which is provided.
2. Engineered to provide integral supply air flow.

B. Standard construction shall comply with National Fire Protection Association; U. S. Department of Agriculture; U. S. Department of Health, Education and Welfare; and National Sanitation Foundation.

C. Have capability to replace 90% of the exhausted air quantity with make-up supply air brought in through the hood's integral supply air system.

D. Continuously welded joints. All joints polished to match adjacent surfaces.

2.2 HOOD ASSEMBLY

A. All exposed surfaces of not less than 18 gage Type 304 stainless steel.

B. Unexposed surfaces of not less than 18 gage galvanized steel.

C. U. L. classified standard construction.

D. Hanger rod brackets welded to canopy as required for proper support.

E. Exhaust and supply duct connections located as necessary to allow proper air flow to and from canopy area being exhausted.

F. Joints and seams shall be liquid tight.

G. Exposed external welds shall be ground, smoothed and polished. No. 3 polish grade.

H. Internal construction: Galvanized steel framing members provided in quantities, types and sizes to prevent flexing, fatigue, vibration or other objectionable movement of the entire assembly.

I. Duct collars: 3-inch minimum height. Exhaust collar minimum of 16 gage steel welded to canopy. Supply duct collar minimum of 18 gage steel pop riveted to canopy.

2.3 SUPPLY AIR SYSTEM

A. Supply air (make-up air) shall be introduced to the immediate area around the hood by registers located on both the face of the hood and the lower front perimeter.

B. Integral supply air registers shall have:

1. Balancing dampers, opposed blade type, adjustable from face of register.

2. Capability of both volume adjustment and air direction to allow supply air to be spread evenly to ensure proper hood operation.

2.4 CONTROL PANEL

A. Mounted on front face of hood. Flush mount unless otherwise indicated.

B. Incorporate the following controls as applicable to the hood system:

1. Toggle switches for hood lights.
2. Fan switches.
3. Status indicator light for each fan switch.

2.5 LIGHTS

A. Fixtures: Vapor proof, incandescent, U. L. listed, 100 watts each. Water proof, heatproof and greaseproof construction. Shock resistant globes with wire guards.

B. Prewired to junction box suitable for field connection to power.

C. Mounted to provide one fixture for each 3-foot (or portion thereof) of canopy length.

2.6 ENCLOSURE PANELS AND FILLERS

A. Provide enclosure panels and fillers as necessary to provide a neat finished appearance when hood assemblies are to be jointed together.

2.7 SIDE SKIRTS

A. Provide where necessary to reduce hood size, to reduce exhaust air quantity or to eliminate cross drafts.

2.8 FILTER ASSEMBLY

A. Filter housing:

1. Constructed of same material as interior hood liner.
2. Terminate into an internally pitched full length grease trough which drains to a removable grease drawer.
3. Constructed and arranged to allow easy access and removal of filters and other apparatus which requires cleaning and maintenance.
4. Provided with all necessary spring clips.

B. Filters:

1. Low velocity type designed for extended servicing interval. All metal stainless steel construction of crimped stainless steel wire mesh. Lifting handles.
2. Cleanable type.

2.9 INSULATION

A. Insulate supply air plenum with 1-1/2-inch thick 3-pcf rigid foil-backed fiberglass board insulation to prevent condensation formation on exterior of hood assembly.

2.10 FIRE SUPPRESSION SYSTEM

A. General:

1. Dry chemical type.
2. Pre-engineered, prepiped, fixed nozzle type.
3. U. L. listed for the hazard and in accord with NFPA No. 96.
4. Conform to all governing codes and standards.
5. Piped, constructed and arranged to provide protection for duct systems, grease removal devices and other necessary components of the kitchen hood system.
6. Provide protection of cooking equipment such as fryers, griddles and broilers which may be a source of ignition of grease in the hood or duct.

B. Operation:

1. Be automatically activated by heat sensitive detectors and also capable of manual activation by a strike button.

C. Auxiliary Equipment: Provide all components, wiring, piping, switches, valves, connection and accessories to provide manual activation, electrical equipment shutdown, gas equipment shutdown, and alarm.

D. Design basis: Ansul R-101 Restaurant Fire Suppression System.

PART 3 - EXECUTION

3.1 GENERAL

A. Install in accord with manufacturer's recommendations.

B. Hang and support entire assemble to be level and plumb.

C. Make all necessary connections related to the electrical and fire suppression systems provided as part of the hood assembly.

3.2 SUPPORT

A. Provide all necessary supporting steel, threaded rods and other material to secure and support the assembly in place so that no vibration, flutter or other such condition is created.

3.3 PLACEMENT AND COORDINATION

A. Locate and erect the assembly is coordination with approved kitchen equipment scaled plan layouts.

B. Coordinate location with related supply air and exhaust air duct systems. Locate so that connecting ductwork can be as vertical as possible and that any horizontal duct runs are minimized. Install with proper clearances from combustibles and from any required fire rated enclosures in which ductwork may be enclosed.

C. Coordinate location with ceiling system. Provide proper interface.

3.4 SYSTEMS COORDINATION

A. Install in coordination with all related fire alarm and suppression systems and in coordination with all related fan and air handling systems which require interlock with the hood systems.

END OF SECTION 23 38 13

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SECTION 23 38 14
FANS: KITCHEN HOOD SUPPLY/EXHAUST ASSEMBLY

PART 1 - GENERAL

1.1 SCOPE

A. Provide pre-packaged supply/exhaust fan assemblies specifically designed for kitchen ventilation system.

B. Provide in size, capacity and with characteristics indicated.

1.2 RELATION TO OTHER WORK

A. Refer to the section "General Mechanical Provisions" for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the drawings and specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division).

1. Ductwork.
2. Hood assembly(s)
3. Controls.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Include complete performance data at the scheduled operating conditions; dimensions; weights; fan performance curves, airside pressure losses; roof curb; attachment of other supports to roof structure; electrical characteristics.

1.5 CERTIFIED PERFORMANCE

A. Fans shall be AMCA certified as to both sound and performance ratings.

1.6 DESIGN BASIS

A. Basis of design is similar to Greenheck Modular Fan Package Model MFP.

1.7 MANUFACTURERS

A. Acceptable: Greenheck, Acme, Penn, Loren Cook, Accurex, or equal.

PART 2 - PRODUCTS

2.1 GENERAL

A. Be a pre-engineered fan package assembly containing both exhaust and supply fan components.

B. Be matched and coordinated to operate in conjunction with the kitchen hood systems to which the fan assembly is connected.

2.2 EXHAUST FAN

A. Fan Hood, Housing and Base: Fan hood, housing and base shall be weatherproof and constructed of heavy gauge aluminum. Motor and drive shall be supported by a structural frame independent of hood, housings, and curb base. Be up-blast type. Have built-in grease drain.

B. Fan Wheel: Shall be backward curved non-overloading, aluminum, airfoil blade type, statically and dynamically balanced. Wheels shall be keyed and locked to shaft.

C. Drive Assembly: Motor and drive assembly shall be located out of the exhaust air stream, cushion mounted on multi-directional neoprene vibration isolators and positively ventilated. Drive shall be direct or belt drive type as indicated on drawings and shall conform with the requirements of Section entitled "General Mechanical Provisions".

D. Disconnect Switch: Fans shall include factory mounted disconnect switches wired to motor.

E. Bird Screen: Provide 1/2" mesh aluminum bird screens on all fans.

F. Additional Requirements:

1. Provide thermal barrier to insulate the wheel compartment from the drive compartment.
2. Be U.L. listed for grease removal.

2.3 SUPPLY FAN ASSEMBLY

A. General: Belt-driven, double-width, double inlet, forward curved centrifugal blower type.

B. Exterior Housing: Minimum 16 gage galvanized steel. Provide with adjustable angle iron support legs.

C. Provide unit inlet with birdscreen and bank of filters.

D. Filters: One inch aluminum mesh type, U.L. classified.

2.4 VIBRATION ISOLATION

A. Provide internal fan vibration isolation.

2.5 ROOF CURB

A. Provide pre-fabricated roof curb of minimum 18 gage galvanized steel with integral wood nailer, run-off cant and 1-inch rigid internal insulation.

B. Insulation shall comply with NFPA 90A as regards flame spread and smoke developed ratings.

C. Curb shall be a minimum of twelve inches (12") high or higher as required to place the fan discharge forty inches (40") above the roof at the lowest point with a foam rubber gasket around the top. Curb caps shall incorporate drainable grease troughs except where such troughs are an integral part of the fan itself.

PART 3 - EXECUTION

3.1 PLACEMENT AND MOUNTING

A. Fan location shall be essentially as shown on drawings; however, actual placement of the roof curb shall be verified using field measurements and data relating to the fans and hoods approved for actual installation on this project. Mount fan and grease trough in strict accordance with the manufacturer's instructions.

B. Coordinate location of supply air intake and exhaust fan outlet to maintain not less than 10-feet separation. Provide housing extension between supply fan and air intake to accommodate this requirement.

END OF SECTION 23 38 17

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SECTION 23 41 00
AIR FILTER ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install complete air filter assemblies of the types, sizes and capacities indicated.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

A. Include complete performance data at the scheduled operating conditions; dimensions; weights; performance curves; airside pressure losses; quantities; descriptions; and any other necessary information.

PART 2 - PRODUCTS

2.1 GENERAL

A. Filters shall pass applicable air quantities at velocities and pressure drops which are within manufacturer's recommended operating ranges and as specified and scheduled.

B. Filter Manufacturers: Continental; American Air Filter; Cambridge; Farr; Flanders; Purafil; or equivalent.

C. Filter Housing Apparatus Manufacturers: Same manufacturer as the applicable filters or same manufacturer as the air handling unit in which installed, whichever manufacturer is applicable.

D. Air Handling Unit Filter Sections: Shall be of adequate size to accept specified filters. Air handling unit filter sections shall be factory made by air handling unit manufacturer or by filter manufacturer to be specifically compatible with applicable air handling unit.

E. Fan Coil Unit and Fan Powered Terminal Unit Filter Box: Integral part of fan coil unit or terminal unit assembly.

1. Access: Filter sections shall be designed for side service access unless otherwise indicated.

2.2 REPLACEABLE THROWAWAY FILTERS, 1-INCH THICK

A. Dacron or fibrous glass multi-ply fiber with 3 graduated density plies. Equal to Continental Conoply Type LD 3 ply, AAF 5700. Galvanized steel or aluminum or fiberboard frame suitable for mounting in applicable filter box. Minimum efficiency: 25% NBS atmospheric dust spot efficiency. Applicable uses: fan coil units; fan powered terminal units at heating coils contained therein.

2.3 INITIAL PREFILTERS FOR AIR HANDLING UNITS

A. Filter Housing: Integral part of air handling unit assembly. (If not part of AHU assembly, provide external filter housing.)

B. Filters: Extended surface, pleated panel type; disposable; double-wall chipboard frame with diagonal support members; 2-inches thick; average efficiency no less than 25-30% based on ASHRAE 52.2-99 test method; operate at an initial resistance of not more than 0.25-inches w.g.s.p. at 500 fpm face velocity. Design base: Farr 30/30.

2.4 FINAL PREFILTERS FOR AIR HANDLING UNITS

A. Filter Housing: Integral part of air handling unit assembly. (If not part of AHU assembly, provide external filter housing.)

B. Filters: Air filters shall be high performance, extended area, deep pleated, disposable type. They shall consist of a filter element, media retainer holding frame and sealer frame. The filter element shall be of the high performance, pre-formed, deep pleated, disposable type. The media shall be microfine glass fiber which is reinforced by a laminated synthetic backing. The filter shall have an average efficiency of 80-85% on ASHRAE Test Standard 52.2-99. It shall have an average arrestance of no less than 98%. The filter shall be listed by Underwriters' Laboratories as Class 1.

C. Media retainer: shall be of welded steel construction and shall be designed in such a manner that it supports the multiple pleats of the filter element against the direction of airflow. The media retainer shall be PVC coated and designed to totally eliminate the possibility of oscillation and/or sagging. Holding Frames shall be factory fabricated of 16 gauge galvanized steel and shall be equipped with gaskets and four spring type positive sealing fasteners. Fasteners shall be capable of being attached or removed without the use of tools. Sealer frames shall be fabricated of 20 gauge galvanized steel and shall be equipped with gasketing material on the rear flange of the sealer frame.

D. Design Base: Farr HP-100.

2.5 EXTERNAL FILTER HOUSING FOR AIR HANDLING UNIT FILTERS

A. Filter Housing: Holding frame of galvanized steel reinforced with bracing and gussets; constructed to provide positive air seal and retainage of filter elements; doors equipped with heavy duty latches and resilient gasketing; designed for side access. Housing shall accept

both initial and final prefilters. Applicable uses: where filter housing is not an integral part of air handling unit assembly. Design base: Farr Model 3P Universal Glide/Pack.

2.6 ACTIVATED CARBON FILTERS

A. Activated carbon filters shall be the full flow high velocity type. Each filter shall contain 90 pounds of activated carbon per 2000 CFM. Filters shall be of size and quantity as indicated on the plans. The casing shall be constructed of galvanized steel: The activated carbon in each filter shall be contained in removable panels constructed of high heat, medium impact polystyrene plastic, to withstand corrosion, and so installed as to preclude the possibility of air bypass. The panels shall contain internal separators to minimize the settling of the carbon and shall be capable of being refilled by the owner. The activated carbon shall have an activity rating of at least 50 minutes by the Standard Government Accelerated Chloropicrin Test. Design base: Farr CF-4.

2.7 HEPA FILTERS

A. Each module shall consist of an all metal corrosion resistant steel casing, steel center divider, filter pack, adjustable flow control, spun steel inlet collar, face screen and integral provisions for attachment of seismic restraints. Module shall be provided for use in lay-in type ceiling and shall be custom manufactured in size as required to fit the lay-in ceiling furnished.

B. The filter pack shall be made with pleated all-glass filter media and safe-edge corrugated aluminum separators. The filter media, separators, and casing components shall be encapsulated in a high stability compound to eliminate any possibility of leaks around the filter media or through the casing joints.

C. The flow control system shall provide each module with the capability of being adjusted to a specified discharge velocity between 25 and 110 fpm with a supply air static pressure between 0.5" and 2.0" w.g. The discharge velocity shall be uniform across the projected face of the module within a tolerance of + 20 fpm.

D. Flow control adjustments and measurements shall be made from the discharge face of the module. A single port of volumetric flow and filter resistance measurements and adjustments and measurement of upstream test aerosol concentration shall be provided in the face of the unit.

E. The module shall be protected by a diamond perforated anodized aluminum screen sealed to the face of the unit. The module shall provide a minimum of 5/8" of bearing and sealing surface when installed on a 1-1/2" T-Bar system.

F. The complete module shall be manufactured, tested and supplied by filter manufacturer. The completed unit shall be tested for efficiency and leaks and certified to have a minimum efficiency of 99.99% on 0.3 micron thermally generated particles and be leak-free per Federal Standard 209B.

G. After test and cleaning, the module face and inlet collar shall be sealed with removable shields to prevent further contamination and protect against damage.

H. Design Base: Cambridge model CAM-1.

PART 3 - EXECUTION

3.1 GENERAL

A. Arrangement and Access: Arrange, install and make provisions for easy access to and removal and replacement of filters. Provide access doors and/or panels as necessary.

B. Coordination and Matching: Coordinate assembly components and properly match sizes and quantities of filters with related air moving systems (e.g., air handling units, fan coil units, filter banks) so that filter assemblies will operate in accord with operating conditions, sizes and capacities as listed in this section or as otherwise indicated.

3.2 MANOMETER

A. Provide a filter manometer for each separate filter bank type (e.g., initial prefilter bank, final prefilter bank) of each air handling unit filter assembly. Do not provide for fan coil units or terminal units. Units shall be complete with pressure fittings, tubing, vent valves, lags, fluid, and the like as required for a complete installation. Acceptable: Dwyer Series 250-AF with pressure range as applicable for filter bank. Not required for fan coil units. Manometers shall be installed in strict accordance with the manufacturer's instructions and in a manner which will not compromise filter access. Provide mounting brackets as required for proper installation. Set red and green signal flags for proper indication of status of the filters involved.

3.3 MISCELLANEOUS SUPPORT STEEL AND HARDWARE

A. Provide as required to provide for adequate support and structural integrity of each filter bank. In no case shall supplementary supports be less than those indicated or recommended by the filter manufacturer in his standard installation instructions.

3.4 FILTER ASSEMBLY LOCATIONS

A. Where scheduled and shown on the drawings.

3.5 ORIGINAL AND SPARE FILTER SETS

A. Provide an original filter set and two (2) spare filter sets for each unit having an air handling equipment filter assembly specified above. Upon initial start-up, each filter assembly shall be provided with a complete original filter set. Prior to or at the time of final test and balance, this original filter set shall be replaced with a complete new spare filter set. However, if at the time of final test and balance there is still useful operating life remaining in the initial filter set (i.e. the filters are still operating within their recommended pressure drop limits for the particular application), then the Contractor (if he is given written approval by the final test and balance agency) may give the spare filter sets to the Owner (at a place of the Owner's selection on the site) in lieu of replacing the original filters with the spare filters.

END OF SECTION 23 41 00

SECTION 23 43 24
AIR PURIFICATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section describes the design, performance and installation of an air purification system intended for use as part of another manufacturer's air handling unit or mounted on the duct as shown on the plans, details and equipment schedules.

1.2 REFERENCED CODES AND STANDARDS

A. The following codes and standards are referenced through out. The edition to be used is that currently enforced by the authority having jurisdiction (AHJ) or in absence of such direction that referenced by the current enforceable IBC code or as indicated by the contract documents, except where specifically referenced by this section of the specifications.

1. ASHRAE Standards 62 & 52
2. National Electric Code NFPA 70
3. UL 867

1.3 RELATED WORK

A. Testing, Adjusting and Balancing

B. Facility Access and Protection

C. Ductwork

D. Filters

E. Water and Refrigerant Piping

F. Electrical Wiring

G. Control Wiring

1.4 QUALITY ASSURANCE

A. The Air Purification System shall be a product of an established manufacturer within the USA.

B. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.

C. Technologies that do not address gas disassociation such as UV Lights, Powered Particulate Filters and/or polarized media filters shall not be considered. Uni-polar ion generators shall not be acceptable. "Plasma" particulate filters shall not be acceptable.

D. Projects designed using ASHRAE Standard 62, IAQ Procedure shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air scheduled with the technology submitted. The manufacturer shall provide independent test data on a previous installation in a similar application, that proves compliance to ASHRAE 62 and the accuracy of the calculations.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for ion generators including:

1. Schedule of plasma generators indicating unit designation, number of each type required for each unit/application.
2. Data sheet for each type of plasma generator, and accessory furnished; indicating construction, sizes, and mounting details.
3. Performance data for each type of plasma device furnished.
4. Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air scheduled (when projects are designed with outside air reduction).
5. Product drawings detailing all physical, electrical and control requirements.

B. Operating & Maintenance Data: Submit O&M data and recommended spare parts lists.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver in factory fabricated shipping containers. Identify on outside of container type of product and location to be installed. Avoid crushing or bending.

B. Store in original cartons and protect from weather and construction work traffic.

C. Store indoors and in accordance with the manufacturers' recommendation for storage.

1.7 WARRANTY

A. Equipment shall be warranted by the manufacturer against defects in material and workmanship. This guarantee shall be by the Contractor to the Owner to replace for the Owner any defective workmanship, equipment, or material which has been furnished under this Contract at no cost to the Owner for a period of one year from the date of acceptance of the System at Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. The air purification system(s) shall be of the size, type, arrangement and capacity indicated and required by the unit furnished and shall be of the manufacturers specified.

B. Acceptable Manufacturers: Plasma Air.

C. All other Suppliers of comparable products requesting prior approval shall:

1. Submit for prior approval in accordance with the requirements of Section 23 01 00.
2. In addition, manufacturers submitting for prior approval for Bi-Polar Ionization must as part of the prior approval request provide their ASHRAE 62.1-2007 calculations that prove conformance to the ASHRAE Standard with the reduction of outside air to the scheduled values. A letter on the manufacturer's letterhead requesting prior approval must accompany the request for prior approval stating their calculations are ASHRAE compliant. A third party validation study performed on a previous installation of the same application shall also be included.

2.2 BI-POLAR IONIZATION DESIGN AND PERFORMANCE CRITERIA

A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a Plasma Generator with Bi-polar Ionization output as described here within.

B. The Bi-polar Ionization system shall be capable of:

1. Effectively killing microorganisms downstream of the bi-polar ionization equipment (mold, bacteria, virus, etc.).
2. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
3. Capable of reducing static space charges.
4. Effectively reducing space particle counts.

C. The bi-polar ionization system shall operate in a manner such that equal amounts of positive and negative ions are produced. Uni-polar ion devices shall not be acceptable.

1. Air exchange rates may vary through the full operating range of a constant volume or VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
2. Velocity Profile: The air purification device shall not have maximum velocity profile.

D. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions within the air purification system.

E. Equipment Requirements:

1. Electrode Specifications (Bi-polar Ionization):

a. Each Plasma Generator with Bi-polar Ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity. Bi-polar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, performance output reduction over time, ozone production and corrosion.
b. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.
c. Manufacture shall demonstrate that no voltage potential exists due to exposed electrical components.

F. Air Handler Mounted Units:

1. Where so indicated on the plans and/or schedules Plasma Generator(s) shall be supplied and installed. The mechanical contractor shall mount the Plasma Generator and associated power supplies. All interconnecting wiring shall be UL and NEC NFPA 70 approved. Electrical contractor shall provide a 120V circuit to the ion generators.

G. Ionization Requirements:

1. Plasma Generators with Bi-polar ionization output shall be capable of controlling gas phase contaminants and shall be provided for all equipment listed above.

   a. The Bi-polar ionization system shall consist of Bi-Polar Plasma Generator and power supply. The Bi-polar system shall be installed where indicated on the plans or specified to be installed. The device shall be capable of being powered by 110VAC to 208VAC to 240VAC without the use of an external transformer. Ionization systems requiring isolation transformers shall not be acceptable.
   b. Ionization Output: The ionization output shall be controlled such that an equal number of positive and negative ions are produced. Imbalanced levels shall not be acceptable.
   c. Ionization output from each electrode shall be a minimum of 15 million ions/cc when tested at 2" from the ionization generator.

2. Ozone Generation:

   a. The operation of the electrodes or Bi-polar ionization units shall conform to UL 867-2007 with respect to ozone generation.

H. Electrical Requirements:

1. Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. Plasma Generator shall accept an electrical service of 115 VAC to 240VAC, 1 phase, 50/60 Hz.

I. Control Requirements:

1. All Plasma Generators shall have internal short circuit protection, overload protection, and automatic fault reset.
2. The installing contractor shall mount and wire the Plasma device within the air handling unit specified or as shown or the plans. The contractor shall follow all manufacturer IOM instructions during installation.
3. Units shall be provided with external ion detector for proof that unit is generating ions.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall be responsible for maintaining all air systems until the owner accepts the building (Owner Acceptance).

3.2 ASSEMBLY AND ERECTION: PLASMA GENERATOR WITH BI-POLAR IONIZATION

A. All equipment shall be assembled and installed in a workman like manner to the satisfaction of the owner, architect, and engineer.

B. Any material damaged by handling, water or moisture shall be replaced, by the mechanical contractor, at no cost to the owner.

C. All equipment shall be protected from dust and damage on a daily basis throughout construction.

3.3 TESTING

A. Provide the manufacturers recommended electrical tests.

3.4 COMMISSIONING AND TRAINING

A. A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.

END OF SECTION 23 43 24

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SECTION 23 54 17
HEATING COILS: ELECTRIC DUCT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide factory assembled and prewired electric duct heaters where indicated. Heater capacities, sizes and operating characteristics shall be as scheduled on drawings or as indicated in other sections.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

A. Refer to requirements of Section entitled "General Mechanical Provisions". Include complete data on heater sizes; required clearances; direction of air flow; control box construction and dimensions; power and control wiring (both factory and field); operating and safety controls; and capacities and operating characteristics.

1.5 MANUFACTURERS

A. Equipment items listed in the schedule on the drawings are based on a specific manufacturer to establish the desired style, quality, performance, and type of equipment. Equal products, complying with the required installation shown on the plans and with these specifications, by the following manufacturers are acceptable:

1. Brasch
2. Tennessee Plastics
3. Indeeco
4. Electric Heaters Division of I.T.E.
5. Valley Industries
6. Dell

PART 2 - PRODUCTS

2.1 GENERAL

A. Each heater shall be UL listed for zero clearance, open coil slip-in type for duct mounting. Sizes, direction of air flow, mounting position, electrical characteristics, and heating capacities shall be as indicated.

1. Meet all applicable requirements of current NEC.
2. UL listed including all built-in components.
3. Be entirely suitable for installation in the indicated locations (ductwork or air handling unit(s) as applicable).
4. Coordinated with the specified requirements of the mechanical system control system.

2.2 MATERIALS AND CONSTRUCTION

A. Galvanized or aluminized steel frame and terminal box with hinged cover.

B. Maximum watt density of 35 watts per square inch of resistance wire surface area (unless otherwise specified).

C. Terminals recessed into air stream 1-1/4 inches minimum.

D. Stainless steel resistance coil terminals and nuts.

E. Iron free resistance wire of 80% nickel and 20% chromium.

F. Reinforced resistance wire bracket supports spaced no greater than four inches apart with stiffening ribs and gussets.

G. Securely positioned terminal insulators and bracket bushings of high quality ceramic.

H. Dielectrically tested for 1000 volts plus twice the rated voltage of 2000 volts, whichever is greater.

I. Heat limiter in each energized heating element power line.

J. Balanced three phase delta connected load if three phase heaters are specified.

K. Insulated terminal box to prevent condensation.

L. Full fine break mercury contactors which will break all ungrounded conductors (note horizontal, vertical or oblique position of each heater assembly as shown on drawings).

M. Transformer with primary fusing if control voltage is different from supply voltage.

N. Overcurrent protection consisting of automatic circuit breaker(s) each installed in accord with NEC requirements.

O. Manual reset thermal cutout in series with a disc type, automatic reset thermal cutout for primary protection, and heat limiters in the heating element power lines to de-energize the elements if the primary cutout fails. Devices shall be serviceable through the terminal box without having to remove heater from duct.

P. Control terminals and power terminals.

Q. Pneumatic-electric switches (one per heater step) when control signal is pneumatic.

R. Built-in or remote pressure type air flow switch. Install in series with automatic reset thermal cutout.

S. Factory mounted integral disconnect switch.

PART 3 - EXECUTION

3.1 GENERAL

A. Arrange and install heater to provide uniform heating of air stream.

B. Properly and firmly support in each location.

3.2 PLACEMENT

A. Heater locations shall be essentially as shown on drawings; however, actual placement shall be verified using field measurements and data relating to the equipment actually approved for installation on this project. Heaters and all controls shall be arranged for horizontal or vertical, top, side or bottom mounting as indicated on drawings. Heater installation shall conform to all governing codes as to clearances, disconnect means, wiring, and like items.

B. Support: Provide duct hangers, and specified in section entitled "Ductwork", immediately adjacent to both sides of heater at both sides of the duct.

C. Duct Openings: Shall be accurately cut, properly reinforced, and gasketed as required for an air tight installation. Insulation shall be finished up to the control box in such a manner as not to compromise service access to heater and provide a proper vapor seal at the edge of the insulation.

3.3 CONTROL COORDINATION

A. Coordinate and provide all items necessary for each heater to operate in accord with the control system sequences and methodology described in other sections of this division.

3.4 TEST AND BALANCE

A. All heater performance shall be certified by test and balance procedures as specified in section covering testing and balancing.

3.5 CLEANING AND PROTECTION

A. Contractor shall protect the heaters from damage from the time of their receipt until final acceptance and shall thoroughly clean the complete heater (including interior of control box) of all dirt and construction debris prior to requesting final inspection. Control box, access door, elements, control and like items which become damaged during the course of

construction shall be required to "as new" condition or shall be replaced with new material or equipment components.

3.6 WIRING DIAGRAMS

A. Provide complete wiring diagram furnished by the heating coil system manufacturer to the mechanical systems control manufacturer and the electrical contractor. This wiring diagram shall completely indicate in full detail all electrical and control wiring requirements, terminals, etc., necessary to allow the control manufacturer and electrical contractor to completely coordinate their respective wiring portions of the heating coil system installation.

END OF SECTION 23 54 17

SECTION 23 57 19
HEAT EXCHANGERS, PLATE TYPE

PART 1 - GENERAL

1.1 SCOPE

A. Provide complete plate type heat exchanger assemblies of the size, capacity and requirements indicated.

1.2 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions, for related requirements. Refer to other sections of the Division 23 and to all other applicable portions of the drawings and specification.

1.3 CODES AND STANDARDS

A. Equipment shall be designed, manufactured and tested in accordance with the latest edition and addenda of ASME Boiler and Pressure Vessel Code Section VIII, Division I, or Section III, Class 3.

1.4 SHOP DRAWINGS

A. Refer to the section entitled, "General Mechanical Provisions".

1.5 BASIS OF DESIGN

A. Basis of design is similar to Baltimore Aircoil "Ener-Changer".

1.6 MANUFACTURERS

A. Acceptable manufacturers are: Baltimore Aircoil, Alfa-Laval, Dean Products, Bell & Gossett, or equal.

PART 2 - GENERAL

2.1 GENERAL

A. Heat exchanger shall consist of a removable assembly of gasketed plates supported in a frame, fitted with inlet and outlet nozzles or studded ports for each fluid stream.

2.2 FRAME

A. Shall provide the structural support and pressure containment for the plate pack; consists of fixed cover, movable cover, upper and lower carrying bars, closing bolts and nuts and carrying bar support column.

2.3 COVERS

A. Fixed Cover: Located at primary stationary end of the plate heat exchanger. Shall contain all four service nozzles or studded ports and shall extend to the foundation on which the heat exchanger stands. The fixed cover end shall be supported by either two legs or one leg extending along the entire width of the exchanger. The other end may have one support leg only.

B. Movable Cover: Shall be supported in a roller bearing hanger from the upper carrying bar along which it can move guided by the lower carrying bar. The movable cover shall provide the other bearing surface and mounting for the opposite end of the closing bolts.

2.4 CARRYING BARS

A. Upper Carrying Bar: Shall be supported horizontally by the fixed cover and the carrying bar support column, to both of which it shall be welded or bolted. A stainless steel Tee section shall be welded to the upper carrying bar to provide the mounting member for the plates of the plate pack.

B. Lower Carrying Bar: Bar shall be welded or bolted to the stationary cover and the carrying bar support column. It shall be sheathed in stainless steel on those three surfaces in contact with the plates and shall be a guide bar only for the plates.

2.5 CARRYING BAR SUPPORT COLUMN

A. Shall extend to the foundation on which the plate heat exchanger is mounted. With the fixed cover it shall support the carrying bars, the upper of which carries the plate pack. The carrying bar support column with the fixed cover shall transmit the static load of the plate heat exchanger to the foundation.

2.6 COMPRESSION BOLTS AND NUTS

A. Compression bolts and nuts shall bear against the fixed and movable cover to close the plate pack to the dimension established by the number of plates in the plate pack.

B. Compression bolts lengths shall accommodate provision for future expansion. Washers shall be provided at both ends of compression bolts.

2.7 PLATE PACK

A. Plate pack shall consist of an assembly of gasketed plates which when compressed between the fixed and movable covers forms the vessel. The plates shall separate the hot liquid from the cold liquid and act as the heat transfer surface.

B. The minimum thickness and design of plates shall be adequate so that each plate can withstand full pressure differential on either side.

C. Design of plates shall have metal to metal contact between adjacent plates.

D. Gasket grooves shall be designed to contain gaskets within the grooves, to provide full gasket support, and to prevent over-compression of the gaskets.

E. Port holes not feeding passes between plates shall be fully gasketed and vented to the atmosphere.

F. Plates shall be fully supported from the top carrying bar and only guided by the bottom bar with reinforced slots integral with the plate.

G. Plate and gasket arrangements shall prevent heating and cooling mediums from coming in contact with either the fixed or movable covers.

H. Each plate shall be pressed from a homogenous piece of sheet metal.

I. End plates shall be furnished at the fixed and movable cover to provide sealing of the first and last flow channel.

2.8 GASKETS

A. Each heat transfer plate shall be fitted with a gasket which contains and separate the liquids between the plates.

B. Gaskets shall be compressed to achieve a metal to metal contact between plates during operation.

C. Relieving grooves shall be provided in the gaskets at those locations where internal seals are used so that, should an internal seal failure take place, it will become immediately evident by visual inspection of the external surface of the exchanger. The relieving grooves shall be located so that no cross contamination of liquids can occur due to internal seal failure without external evidence, as described above.

D. Each plate with a gasket in place shall undergo a curing operation at a temperature no less than the exchanger normal operating temperature, for a duration of one hour. After curing, all gaskets shall be checked. Deformed gaskets shall be replaced and the curing operation shall be repeated on new gaskets.

2.9 NOZZLES

A. Provide 150-lb ASA rated loose flange type.

2.10 OTHER REQUIREMENTS

A. Plate Design: Unit shall be supplied with a mixed Herringbone Plate Design so that the unit can be optimized with respect to minimum pressure drops and heat transfer surface required for the duty. Mixed plate design shall consist of plated of varying corrugation configurations, but of the same size, mixed in the plate pack to optimize heat transfer, flow rates, and pressure drop.

B. Lifting lugs to facilitate handling of exchanger and component shall be provided and designed to withstand the flooded weight of the unit.

C. Identification: All plates shall be marked with type reference symbol and individually numbered in sequence.

D. Arrangement: Unit shall be arranged for single pass flow on each side so that all piping connections are located at the fixed end, permitting the heat exchanger to be opened for inspection or cleaning without disturbing the piping. In addition, the inlet and outlet connections for each stream will be located on the same side of the exchanger to facilitate piping. Units shall be designed to be self-draining whenever possible.

PART 3 - EXECUTION

3.1 GENERAL

A. Install in accord with manufacturer's recommendations.

B. Arrange to allow all necessary access for servicing and maintenance.

C. Provide all necessary support for the assembly.

D. Coordinate piping connections with flow diagrams and layout shown on Drawing.

END OF SECTION 23 57 19

SECTION 23 64 26
ROTARY-SCREW WATER CHILLERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes packaged, water-cooled, electric-motor-driven, rotary-screw water chillers with the following features:

1. Motor controller.
2. Microprocessor-based controls.

B. See Division 23 Section "Refrigerant Monitoring and Safety Equipment" for refrigerant monitors, alarms, supplemental breathing apparatus, and ventilation equipment interlocks.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Complete set of manufacturer's certified prints of water chiller assemblies, control panels, sections, and elevations, and unit isolation.

1. Include wiring diagrams.

C. Coordination Drawings: Floor plans drawn to scale and coordinated with the following:

1. Structural supports.
2. Piping roughing-in requirements.
3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

D. Source quality-control test reports.

E. Startup service reports.

F. Operation and maintenance data.

G. Warranties.

1.3 QUALITY ASSURANCE

A. ASHRAE Certification: Signed by manufacturer certifying compliance with ASHRAE 15 for safety code for mechanical refrigeration. Comply with ASHRAE Guideline 3 for refrigerant leaks, recovery, and handling and storage requirements.

B. ASME Compliance: Fabricate and label water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. Comply with NFPA 70.

D. Comply with UL 1995.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water chillers that fail in materials or workmanship.

1. Product shall be warranted parts and labor for one year.
2. Compressor shall have five year warranty on parts.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Trane Company (The).
2. Approved equal.

2.2 PACKAGED WATER CHILLERS

A. Description: Factory-assembled and -tested water chiller complete with compressor, evaporator, condenser, controls, interconnecting unit piping and wiring, indicated accessories, and mounting frame.

2.3 COMPRESSORS

A. Description: Positive displacement, oil injected with direct-drive, semi-hermetic motor.

1. Casing: Cast iron, precision machined for minimum clearance about periphery of rotors.
2. Rotors: Single screw.

B. Capacity Control: Hydraulically operated, modulating or stepped sliding valve to maintain chilled-water temperature set point without hunting within throttling range. Throttling range shall be from 100 to 10 percent of full load.

C. Oil Lubrication System: Positive-displacement submersible pump with heater, oil filter, and sight glass.

D. Refrigerant and Oil: HCFC-22, HFC-134a, R-407c, or R-410a.

2.4 HEAT EXCHANGERS

A. Evaporator:

1. Description: Shell-and-tube design, ASME labeled.
2. Shell Material: Carbon steel.
3. Tube Construction: Individually replaceable, expanded into tube sheets.

    a. Material: Copper.
    b. Internal Finish: Enhanced.

4. Water Box: Standard, with design working pressure of 150 psig, and having flanged water-nozzle connections with a thermistor-type temperature sensor factory installed in each nozzle.

B. Condenser:

1. Description: Shell-and-tube design, ASME labeled.
2. Shell Material: Carbon steel.
3. Tube Construction: Externally enhanced and individually replaceable, expanded into tube sheets.

    a. Material: Copper.
    b. Minimum Size: 3/4-inch OD; 0.028-inch wall thickness.
    c. Internal Finish: Enhanced.

4. Water Box: Standard, with design working pressure of 150 psig, and having flanged water-nozzle connections with a thermistor-type temperature sensor factory installed in each nozzle.
5. Provide with condenser head pressure control valves for low ambient operation protection.

2.5 INSULATION

A. Cold Surfaces: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type II, for sheet materials.

2.6 ACCESSORIES

A. Pressure Relief Valve: Single- or multiple-reseating-type, spring-loaded relief valve.

2.7 CONTROLS

A. Control Panel: Stand-alone, microprocessor based.

B. Coordinate communication accessory requirements for proper communications with the Direct Digital Control system. Provide all communication components, Lon interface cards, etc. as required for full integration into the control system.

C. Enclosure: Unit-mounted, NEMA 250, Type 1 enclosure, hinged or lockable; factory wired with a single-point power connection and a separate control circuit.

D. Status Display: Multiple-character liquid-crystal display or light-emitting diodes and keypad. Display the following conditions:

1. Date and time.
2. Operating or alarm status.
3. Operating hours.
4. Outside-air temperature if required for chilled-water reset.
5. Temperature and pressure of operating set points.
6. Entering and leaving temperatures of chilled water.
7. Entering and leaving temperatures of condenser water (for water-cooled water chillers only).
8. Refrigerant pressures in evaporator and condenser.
9. Saturation temperature in evaporator and condenser.
10. Oil temperature and pressure.
11. Percent of maximum motor amperage.
12. Current-limit set point.
13. Number of compressor starts.

E. Control Functions:

1. Manual or automatic startup and shutdown time schedule.
2. Entering and leaving chilled-water temperature, control set points, and motor load limit. Chilled-water temperature shall be reset based on return-water temperature.
3. Current limit and demand limit.
4. Condenser-water temperature.
5. External water chiller emergency stop.

F. Manually Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:

1. Low evaporator temperature; high condenser pressure.
2. Low chilled-water temperature.
3. Low oil differential pressure.
4. High or low oil pressure.
5. High oil temperature.
6. High compressor-discharge temperature.
7. Loss of chilled- or condenser-water flow.
8. Electrical overload.
9. Sensor- or detection-circuit fault.
10. Processor communication loss.
11. Starter fault.

2.8 MOTORS

A. Refer to Division 23 Section "Motors" for general requirements.

B. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

1. Open-drive motors shall have flanged or flexible coupling suitable for direct connection to compressor.

2.9 MAGNETIC ENCLOSED CONTROLLERS

A. Enclosure: Unit mounted, NEMA 250, Type 1, with hinged access door with lock and key or padlock and key.

B. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of enough capacity to operate connected pilot and indicating and control devices.

C. Overload Relay: Shall be sized according to UL 1995 or shall be an integral component of water chiller control microprocessor.

D. Star-Delta Controller: NEMA ICS 2, closed transition.

E. Solid-State, Reduced-Voltage Controller: NEMA ICS 2.

1. Surge suppressor in solid-state power circuits providing 3-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
2. Light-emitting-diode indicators showing motor and control status, including the following conditions:

a. Controller on.
b. Overload trip.
c. Loss of phase.
d. Starter fault.

F. Accessories: Devices shall be factory installed in controller enclosure, unless otherwise indicated.

1. Phase-Failure and Undervoltage Relays: Solid-state sensing circuit with adjustable undervoltage setting and isolated output contacts for hard-wired connections.

2.10 SOURCE QUALITY CONTROL

A. Factory test and rate water chillers, before shipping, according to ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle." Stamp with ARI label.

B. Factory test heat exchangers hydrostatically at 1.50 times the design pressure.

C. Factory test and inspect evaporator and water-cooled condenser according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Stamp with ASME label.

D. Factory test and inspect water boxes at 150 percent of working pressure.

E. Rate sound power level according to ARI 575 procedure.

PART 3 - EXECUTION

3.1 WATER CHILLER INSTALLATION

A. Install water chillers on concrete base. Concrete base is specified in Division 23 Section "Basic Mechanical Materials and Methods," and concrete materials and installation requirements are specified in Division 03.

B. Concrete Bases: Anchor chiller mounting frame to concrete base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Cast-in-place concrete materials and placement requirements are specified in Division 03.

C. Vibration Isolation: Rubber pads with a minimum deflection of 0.25 inch. Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration Isolation Equipment."

D. Vibration Isolation: Mount water chiller on vibration isolation equipment base as specified in Division 23 Section "Vibration Isolation Equipment."

E. Maintain manufacturer's recommended clearances for service and maintenance.

F. Charge water chiller with refrigerant if not factory charged.

G. Install separate devices furnished by manufacturer.

3.2 CONNECTIONS

A. Chilled- and condenser-water piping installation requirements are specified in Division 23 Section "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to chiller to allow service and maintenance.

C. Evaporator Connections: Connect inlet to evaporator with controller-bulb well, shutoff valve, thermometer, strainer, pressure gage, and union or flange. Connect outlet to evaporator with shutoff valve, flow switch, balancing valve, thermometer, pressure gage, and union or flange.

D. Condenser Connections: Connect inlet to condenser with shutoff valve, thermometer, plugged tee, and pressure gage. Connect outlet to condenser with shutoff valve, thermometer, drain line and shutoff valve, strainer, and plugged tee.

E. Refrigerant Pressure Relief Valve Connections: Extend vent piping to the outside without valves or restrictions.

F. Ground water chillers according to Division 26 Section "Grounding and Bonding."

G. Connect wiring according to Division 26 Section "Conductors and Cables."

3.3 STARTUP SERVICE

A. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.

B. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
2. Verify that pumps are installed and functional.
3. Verify that thermometers and gages are installed.
4. Operate water chiller for run-in period according to manufacturer's written instructions.
5. Check bearing lubrication and oil levels.
6. Verify that refrigerant pressure relief is vented outside (for water-cooled water chillers).
7. Verify proper motor rotation.
8. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
9. Verify and record performance of chilled- and condenser-water flow and low-temperature interlocks.
10. Verify and record performance of water chiller protection devices.
11. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

C. Prepare a written startup report that records results of tests and inspections.

D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION 23 64 26

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SECTION 23 65 13
COOLING TOWERS, PACKAGED, INDUCED DRAFT, STAINLESS STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Direct Digital Control System.
2. Water treatment systems
3. Chillers, centrifugal
4. Performance Verification.
5. HVAC Pumps.
6. Electrical sections.

1.2 SCOPE

A. Provide, test and adjust complete package type, vertical discharge, induced draft, double-cross flow cooling tower assemblies of the capacity, operating and electrical characteristics indicated on the drawings as specified herein.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

A. Refer to the Section entitled "General Mechanical Provisions". Include complete data on: unit dimensions, minimum operating and service clearances, capacities and rating conditions, maximum operating weights, fan and motor horsepower, motor type and wiring arrangements, materials of construction, fan drive, static and dynamic pump head losses, details of piping support at fan casing and all accessories.

1.5 OTHER REQUIREMENTS

A. Be suitable for installation on top of steel or concrete supports as indicated on Drawings.

B. Furnished complete with all accessories, appurtenances, and like items as required to provide a complete system which functions as described and implied.

C. Maximum drift loss not greater than 0.010 % of design condenser water flow rate.

1.6 CAPACITY AND RATING CONDITIONS

A. Tower's thermal performance shall be certified by the Cooling Technology Institute (CTI). Tower performance shall be guaranteed to meet the specified operating conditions when tested by an independent testing agency in accordance with ASME Standard PT-105 or CTI test procedures.

B. CTI certification notwithstanding, the cooling tower manufacturer shall guarantee that the tower supplied will meet the specified performance conditions when the tower is installed as indicated for this specific project. If, because of a suspected thermal performance deficiency, the Owner chooses to conduct an on-site thermal performance test under the supervision of a qualified, disinterested third party in accordance with CTI or ASME standards during the first year of operation; and if the tower fails to perform within the limits of test tolerance; then the cooling tower manufacturer will pay for the cost of the test and will make such corrections as are appropriate and agreeable to the Owner to compensate for the performance deficiency.

C. The tower shall be capable of cooling the scheduled water flow rate from the entering conditions given to the leaving conditions given while operating in the scheduled ambient wet bulb conditions.

1.7 STRUCTURAL AND WIND LOADING DESIGN CONDITIONS

A. The tower and all its components shall be designed to withstand a wind load of 30 psf (1.44kPa), as well as a 0.3g seismic load. It shall be designed to withstand shipping and hoisting loads of 2g horizontal and 3g vertical.

B. The fan deck and hot water basin covers shall be designed for 50 psf (2.42 kPa) live load or a 200 lb. (91 kg) concentrated load.

C. Handrails, where specified, shall be capable of withstanding a 200 lb. (890 N) concentrated live load in any direction, and shall be designed in accordance with OSHA guidelines.

1.8 MANUFACTURER

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Marley
2. Baltimore Air Coil
3. Evapco

B. Basis of Design: This specification is based on the following manufacturer and model/series number for purposes of conveying the minimum acceptable level of quality, performance and features:

Marley NC Diamond Series

1.9 WARRANTY

A. The entire tower, including structure, casing, basins, decking, fan(s), motor(s), and all mechanical drive components (including belts, if used) shall be warranted against failure due to defects in materials and workmanship for a period of five (5) years from the date of shipment to the job. Towers not covered by a warranty of this scope will not be accepted.

PART 2 – PRODUCTS

2.1 GENERAL CONSTRUCTION

A. Fireproof design. The tower shall include all design and material modifications necessary to meet the fire rating requirements of Factory Mutual. The product proposed shall be listed in the FM Approval Guide, latest edition.

B. Except where otherwise specified, all components of the cooling tower shall be fabricated of heavy-gauge, series 300 stainless steel. The tower shall be capable of withstanding water having a chloride content (NaCl) up to 750 ppm; a sulfate content (SO4) up to 1200 ppm; a calcium content (CaCO3) up to 800 ppm; silica (SiO2) up to 150 ppm; and design hot water temperatures up to 125°F (51.7°C). The circulating water shall contain no oil, grease, fatty acids, or organic solvents.

2.2 FRAMEWORK

A. Heavy gauge series 300 stainless steel.

2.3 CASING AND FAN DECK

A. Heavy-gauge series 300 stainless steel capable of withstanding the loads previously described.

2.4 FAN GUARD

A. Conical, non-sagging, removable fan guard at top of each fan cylinder.

B. Fabricated of welded 5/16" (8mm) and 7 gauge rods, and hot dip galvanized after fabrication

2.5 LOUVERS

A. Non-sagging design and construction. Either same material as casing, or thermoformed to be integral with the fill sheets.

B. Air inlet faces of the tower shall be free of water splash-out.

2.6 COLD WATER BASIN

A. Heavy gauge series 300 stainless steel. Self cleaning with depressed center section, cleanout and drain fittings. Basin and tower shall be completely self-supporting when resting on two support beams.

B. Interconnect basins of adjacent cells with stainless steel flumes and slide weir gates for flow and equalization between cells for towers of more than one cell. Interconnecting flume between cells shall be equipped with removable cover plate to permit the shutdown of one cell for maintenance purposes, or to permit independent cell operation.

C. Provide the number and type of suction connections required to accommodate the outflow piping system indicated for this project.

D. Provide stainless steel debris screens for each suction connection.

E. Provide a 4-inch minimum diameter PVC pipe overflow in each tower cell.

F. Include depressed center section into which accumulated silt can be flushed and overflow standpipes shall be removable to permit flush-out cleaning of the basin. Basin floor adjacent to depressed section shall slope toward depressed section to prevent silt build-up under fill area.

2.7 ACCESS TO BASIN AND PLENUM AREA

A. Access Doors: Provide a stainless steel access door not less than 30" (762mm) wide and not less than 33" (838mm) high at both endwalls for entry into the cold water basin and fan plenum area. Operable from inside as well as outside the tower.

B. Plenum Walkway: Provide galvanized steel bar grating walkway extending from one endwall access door to the other endwall. Support walkway by stainless steel framework. Top of grating shall be at or above cold water basin overflow level.

2.8 DISTRIBUTION SYSTEM

A. All components of the hot water distribution system shall be stainless steel except for distribution nozzles.

B. Open gravity type using stainless steel distribution pans. Removable, interchangeable polypropylene nozzles installed in the floor of these basins shall provide full coverage of the fill by gravity flow

C. Removable stainless steel distribution pan covers.

D. Each basin shall include an inlet hole and bolt circle to accept a 125# flange connection per ANSI B16.1.

E. Heavy-duty flow-regulator valves at hot water inlet connections to each distribution pan section. Valves shall be disc type, with cast iron bodies, stainless steel operating stems, with locking handle to maintain valve setting in any position. Valves shall be right angle configuration, precluding the need for inlet elbows.

2.9 FLOAT OPERATED MAKE-UP VALVE

A. Provide a factory installed, float operated, mechanical makeup valve for each basin of each tower cell.

2.10 FILL AND DRIFT ELIMINATORS

A. Fill: Non-corrosive; non-ferrous; replaceable; vertical polyvinyl chloride (PVC) sheets.

B. Drift eliminators: PVC; sag-proof supports. Limit drift losses

2.11 FANS AND DRIVES

A. The complete fan, motor and drive assembly for each cell shall be supported by a rigid, welded, stainless steel structural support that resists misalignment between the motor and the gear reducer.

B. Fans(s):

1. Propeller type, axial flow.
2. Blades: Heavy duty aluminum allow with electro-galvanized hubs. Individually adjustable blades.

C. Fan Drive: Parallel shaft or right angle gear-reducer or multi-groove single belt band type. Right angle, industrial duty, oil lubricated, geared speed reducer requiring oil change no often than every five years of operation.

D. Bearings: Equipped with external lubrication fittings. Provide oil level sight glass for gear drive and protection for drive and fan in accordance with OSHA standards. Minimum L10 life of 40,000 hours.

E. Sound Attenuation: Provide with low noise fan.

2.12 MOTORS

A. Totally enclosed fan cooled; 1.15 service factor; variable torque, 1800 RPM maximum; specially insulated for cooling tower duty.

B. Motor shall operate in shaft-horizontal position.

C. Be rated for operation with variable speed drive or be provided as a 2-speed motor, whichever is indicated on drawings and/or in control sequence. Nameplate horsepower shall not be exceeded at design operation.

2.13 HARDWARE AND FINISH

A. Be of non-corrosive materials.

B. Bolts, Nuts and Washers: Compatible electrolytically with the metals being connected or joined.

C. All other steel not required to be stainless steel shall be hot dipped galvanized with minimum coating of 2.25 ounces per square foot.

2.14 OTHER ITEMS

A. Access Ladders: Aluminum or galvanized steel. Comply with OSHA standards.

B. Handrail: Around upper perimeter of tower. Comply with OSHA standards.

C. Vibration Sensor: Provide a vibration sensor (adjustable for sensitivity) designed to stop the cooling tower fan due to any excess vibration of the; fan, gear drive or motor. Provide auxiliary alarm contact.

D. Oil Level Switch: Provide an oil level switch to stop the tower fan due to low oil level in gear reducer.

2.15 OPENINGS IN CASING FOR MAKE-UP WATER PIPING

A. Factory provided openings to facilitate make-up water piping configurations indicated on the drawings, and adequate in size to pass insulated pipe. Factory reinforcing around opening if required.

2.16 PIPING SUPPORT

A. Supply piping to header shall be supported from cooling tower casing.

PART 3 – EXECUTION

3.1 COORDINATION

A. Coordinate all matters (including, but not limited to, access, mounting height; fluid and electrical conduit connections and other similar items) related to the installation and proper function of the entire cooling tower assembly.

3.2 TESTS

A. Perform all tests necessary to establish the specified performance of the cooling tower assembly.

3.3 DISCHARGE CONE HEIGHT

A. Install top of discharge cone to be level with top of surrounding screen wall if wall is applicable.

3.4 TOWER PLACEMENT

A. The tower location shall be essentially as shown on drawings; however, actual placement shall be verified using field measurements and data relating to the units approved for actual installation on this project. Install the tower on the supports furnished as work of another Section.

3.5 STARTERS AND WIRING

A. Be compatible with variable speed type or two speed type fan drive motors, depending on method of control described in Division 23 section describing DDC control system for HVAC systems. All wiring shall comply with Electrical Division of these Specifications.

3.6 PIPING

A. Piping shall be essentially as shown on the drawings. Assemble, mount and pipe such miscellaneous accessory items as make-up and float valves, drain valves and piping, and hose bib for flushing and cleaning towers. Provide adequate support hardware to support supply branch piping from cooling tower casing.

3.7 ERECTION

A. Provide all plant, materials, equipment and labor to perform any field erection and assembly of the tower and its accessories.

3.8 CLEANING

A. After assembly and prior to filling tower or condenser water system the tower shall be thoroughly cleaned and flushed to remove all dirt and debris.

3.9 CHEMICAL TREATMENT SYSTEM

A. Coordinate with the water treatment system specified. Provide all interfacing connections (pipe, valves, drains and similar items).

END OF SECTION 23 65 13

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SECTION 23 71 00
THERMAL BATTERY COOLING SYSTEM

1.1 GENERAL

A. The thermal battery - Ice Storage System, shall be supplied from one single source with complete system responsibility. The Ice Storage system, including chiller(s), ice tank(s), plate and frame heat exchanger, and ice storage system control (as specified elsewhere), shall be provided by a single organization. The system supplied must provide twenty-four-hour design day cooling system capacity and performance as indicated in the plans and specifications. This organization shall have factory trained service technicians who will be responsible for the start-up and first year parts and labor warranty of the system including warranties listed elsewhere in the bid documents. The Ice Storage system equipment manufacturer must have supplied at least 10 systems of 5,000 ton-hours or more capacity within a radius of 50 miles of the job site, all of which have operated successfully for at least five years. The Ice Storage Tank, comprised of an insulated vessel and internal heat exchanger tubing, shall be modular in design and be field connected into groups of 2, 3 or 4 ice storage tanks as shown on the plans. The field connected storage vessels shall be of equal capacity to facilitate balancing and shall be filled with water as a freezing fluid, such that the ice tank heat exchanger is totally submerged. The ice tank heat exchanger, in all thermal storage tank modules, shall be piped in parallel and a chilled polypropylene glycol solution of XX% shall be circulated through the tubes. In the charging mode of operation, a cooled glycol solution shall cause ice to form and build on the tube surfaces. In the discharging mode of operation, the melting ice from around the tube surfaces shall cool the glycol solution. The Storage Tanks shall be of the Internal Melt design (the term comes from the fact that during the discharge mode of operation the ice is melted from the tube surface internal to the ice that encases the tube).

B. CALMAC Ice Bank is basis of design. Encapsulated and external melt systems are not acceptable.

1.2 ICE STORAGE SYSTEM PERFORMANCE

A. Daily performance of the ICE ENERGY STORAGE system shall be as scheduled on the twenty-four-hour load profile in the specifications and/or on the drawings. Suppliers shall provide information in accordance with the current *ARI Guideline for Specifying the Thermal Performance of Cool Storage* that proposed equipment will meet minimum performance specified. Each Ice Storage Device shall have factory rated and published charge and discharge performance curves that clearly indicate usable ton-hours of storage at the system design temperatures shown in the plans and specifications. Usable ton-hours shall be shown on these curves and shall be provided with the submittal package. Average supply charging temperature of the glycol (average supply temperature over ice making hours) and final charging temperature must meet minimum scheduled performance as listed. Chiller performance, capacity, and efficiency must also comply with the performance scheduled. Manufacturer’s computer selection program output must demonstrate net usable ton-hours using design day load profiles based on actual operating conditions. If the ice making chillers have centrifugal compressors, chiller manufacturer and ice tank manufacturer must provide a written and signed statement indicating that the equipment provided is a proper match with bid documents.

1.3 ICE STORAGE VESSELS

A. The modular ice storage tank design shall incorporate structure and storage fluid containment in a one-piece (sides and bottom) seamless vessel or seamless containment liner designed for a minimum 30-year service life and shall be constructed solely of corrosion-resistant materials. The vessel shall consist of a seamless one-piece design manufactured with rotationally molded

corrosion resistant polypropylene with an average thickness of 3/8 inch (9.5 mm) and a minimum ultimate strength of 2600 psi (18,000kPa) per ASTM D 638-08.

B. The vessel shall include a factory assembled isolated expansion chamber to prevent expansion water from forming capacity reducing ice caps. The vessel shall be totally repairable in the field. Installations shall require no more than three feet of overhead clearance for any ice tank heat exchanger or liner repair.

C. If required by installation manual, manufacturers of thermal storage tank vessels shall provide, install, and warrant tank safety switches and temperature sensors. Manufacturer shall notify control contractor of the quantity of safety BAS points required for the tank farm. Float switches, inventory meters, and sensors shall be included in the ice tank warranty.

D. Steel structured tanks with containment liners may be used if provided with a duplex coating consisting of a powder coating over hot-dipped galvanized steel. The duplex treatment is to include all exterior and interior surfaces, edges, and all internal support structures. Steel vessels must include a minimum of 18 inches between adjacent vessels and walls to perform exterior wall and frame corrosion inspections and maintenance without extending the basis of design tank farm footprint.

E. The duplex treatment shall be applied to all exposed steel and metal edges and welds. Ice tank and fluid containment shall be warranted as designated under warranty section.

F. All thermal storage tanks, and if needed tank liners, must be designed and able to withstand, without damage or distortion, repeated cycles of total freezing of ALL water within it which may be due to control malfunctions or ambient temperatures. Damages caused by a total freeze shall be repaired by manufacturer during warranty period defined in the ice tank vessel warranty in this specification. A total freeze shall not void warranty other warranty coverages.

G. All thermal storage vessels must be capable of being re-deployed after original commissioning for use at other sites with remaining specified warranty in force. If redeployment is not possible without a redeployment kit, provide price add for entire system add for redeployment capabilities.

H. Manufacturers of thermal storage tank vessels shall provide, install, and warrant all heat tracing tape if required for inventory meters, site glasses, and connections.

1.4 ICE TANK HEAT EXCHANGER

A. The ice tank shall contain a spiral-wound, mat type heat exchanger, constructed entirely of polypropylene headers and 5/8-inch O.D. polypropylene tubing arranged in multiple parallel circuits with OPPOSITE direction of flow in adjoining tubes for even ice making and melting. To avoid blockages from sediment accumulation, a majority of the heat exchanger surface shall be oriented in a horizontal manner. To avoid blockages from particulate the minimum aperture that coolant will need to pass through shall not be less than 3/8”.

B. Manufacturers supplying heat exchanger tubing with a majority of vertical flow paths must install and warrant a self-cleaning 5-micron glycol fluid filter and strainer system to filter glycol entering tank farm to eliminate tube blockages in heat exchanger tubes.

C. All heat exchanger connections and internal header connections shall be welded. Mechanical fittings of any kind are not acceptable. *If the tank heat exchanger tubing and the internal tank distribution piping do not include welded construction, the ice tank manufacturer must provide factory personnel to annually inspect all mechanical connections for twenty-five years.*

D. Steel heat exchanger tubes (1.05" O.D.) may be used provided steel framework is hot dip galvanized and powder coated after fabrication and coated as directed above in tank specification. All ice tank heat exchangers shall be warranted as specified elsewhere.

E. The heat exchanger shall be capable of operating up to a 90 psi (620 kPa) maximum pressure and shall have a burst pressure rated for 4 times the maximum operating pressure.

F. Each ice tank heat exchanger and its associated piping shall be factory hydrostatically-pressure tested to a minimum of 250 psi (1724 kPa) after tank insertion, not prior, and be documented. The pressure test documents shall be supplied with tanks upon request.

G. Multiple modular thermal storage tank systems shall be piped parallel in reverse return for self-balancing. At design conditions the ice tank flow shall not change greater than 3% by varying the pressure across the tank farm by one foot (0.43 psi). Manufacturers unable to meet this criterion must provide install and warrant balancing valves for the tank farm. Manufacturer must provide pressure drop curves of ice tank with submittal package.

H. The heat exchanger should be repairable without removal from tank Ice tanks that require removal of heat exchanger for tube repair shall include enough room in their ice tank farm footprint for rigging apparatus and have preapproval for space acquisition and layout changes by engineer. If removal of tank heat exchanger is required during warranty period, tank manufacturer shall provide to owner, at their option, money or labor for heat exchanger removal and replacement during containment warranty period.

I. Pressure relief valves between each tank, and valves that connect the tank to the system, must be provided and warranted by non-basis of design ice tank manufacturer's if required by that ice tank manufacturer.

1.5 ICE TANK COVERS

A. Covers shall be provided for all ice modules and/or tanks. Covers for buried vessels shall be designed to support architectural landscaping wood chips, or other similar material, having a maximum depth of twelve inches. Covers shall also support the weight of 2 average adults (200 pounds) at any point on the tank farm.

B. Covers shall be in modular sections that can be readily lifted, removed, and replaced by two men. Each section shall weigh no more than 250 pounds and shall have smoothed edges or handles for easy and safe gripping.

C. Each vessel shall have at least one inspection port in the cover, which can be used for visual inspection, determining liquid level, and for filling the vessel with water, without removing the cover(s).

D. Covers for steel vessels shall be a minimum of 16 gauge stainless or 14 gauge for hot dipped galvanized and powder coated steel of the same process used on sides, bottom and support structures.

E. Ice tank covers shall have seamless tops to prevent rainwater or snow melt from entering ice tank. Warranty coverage for ice tank covers shall include replacement covers if lids allow rainwater to enter tank during warranty period.

1.6 ICE TANK INSULATION

A. The bottom, sides and cover(s) of each vessel shall be factory insulated. Insulation on the interior of the structural containment vessel is unacceptable.

B. Manufacturer must provide adequate insulation to limit standby losses not to exceed ONE PERCENT of the total stored capacity when in an 85-degree F. environment for a period of twenty-four hours.

C. For polypropylene vessels that freeze solid the bottom and the sides of the tank shall be insulated externally with a minimum of two inches of expanded polystyrene or polyurethane applied in overlapping layers having a total minimum R- factor of nine (9). Insulation of sides shall be covered with a .032-inch-thick aluminum jacket for protection and reflectance.

D. The covers of all vessel types shall have insulation injected into the interior cavity of the cover and have an average R- factor of 24. Insulation with direct access or contact with the storage fluid or ambient air is not acceptable.

E. For stainless steel or duplex coated steel vessels insulation meeting the standby loss criteria shall be applied between the exterior of the containment wall or pool type liner and the interior of the structural support system. Insulation of sides and bottom of vessel shall be covered with a minimum 30 mil thick PVC or EPDM impermeable liner, with all seams and joints double lapped and solvent welded. All fastening materials used to hold the liner in place shall be non-corrosive plastic, or stainless steel. Galvanized fasteners are not acceptable.

1.7 ICE STORAGE COOLING SYSTEM

A. Hydrostatically flush clean and field pressure test all piping EXTERNAL to thermal storage tanks as specified elsewhere to remove welding slag, flux, and dirt. If hydrostatic test is with water the ice storage tanks shall be valved off (isolated) to eliminate filling the ice tanks with water, which cannot be easily replaced with the pre-mixed glycol.

B. After successful completion of the test, drain the system and add premixed glycol to the system as described in another part of the specification. Upon completion of the filling and removal of air, pressures test the ice tanks in accordance with manufacturer's recommendations.

C. The system shall be filled with a pre-mixed glycol solution resulting in a minimum three parts de-ionized water to one part inhibited glycol when operation. (25% mixture or greater as specified elsewhere can be initially installed and local approved tap water can be used to bring system to final 25%). Glycol shall be a formulated premixed product like Dowtherm or Wintrex. Automotive glycol, and field inhibited glycol is not acceptable. See heat transfer fluid specification. The piping system shall contain a 2-inch fill port on the suction side of the system glycol pumps.

D. A lug type, full flow shut off valve shall be included (supplied by contractor) for field installation and insulation in the supply and return lines of each grouping of 3 tanks. Liquid level, and/or pressure switches in the expansion tank shall provide glycol system leak protection.

E. Tank bottoms shall be level and supported over the entire area and insulated from their supporting surface with insulation supplied by the tank manufacturer. Follow manufacturer's installation recommendations for partially buried or totally buried tanks.

F. The thermal storage farm system shall be provided with ice inventory-measuring device, which will indicate the amount of ice available at any time within an accuracy of +/- 5 percent. Each ice tank manufacturer shall provide the number of meters indicated in their installation literature. This ice

inventory measuring device(s) shall also be equipped with an electric transducer capable of producing a 4 - 20 ma. signal which can interface with the building automation system.

G. This device is for indication only and is NOT TO BE USED FOR TERMINATION OF CHARGE CYCLE CONTROL OF ICE SYSTEM.

1.8 TREATMENT OF PHASE CHANGE WATER

A. The ice tank manufacturer shall supply the first water treatment chemicals required for treatment of the phase change water against biological growth AND tank corrosion.

B. The treatment must eliminate algae, bacteria, and metal corrosion (if metal tanks supplied). The submittal documents must contain the name(s), and quantities required for the ten-year chemical treatment. Rules for handling, storing, and the amount of room required for storing, , and rules for application must also be provided. Manufacturer of ice tanks using galvanized steel heat exchangers or mechanical fittings and fasteners must provide an annual inspection by factory-trained personnel for heat exchanger and tank corrosion during warranty period shown below.

1.9 ICE TANK VESSEL WARRANTY (tank containment)

A. The ice tanks (containment vessels) shall be warranted to cover all parts of the tank vessel against manufacturing defects for 10 years from the date of shipment to the jobsite. Manufacturers of ice tanks that require the installation of float switches, heat tracing tape, tank pressure relief valves, sight glass, and corrosion protection for phase change fluid containment and/or rain multi-piece covers shall provide a parts warranty to include all components of the containment system for TEN YEARS from date of shipment to jobsite. A *warranty certificate of authenticity* must be provided from the manufacturer at the time of submittal specifically mentioning the tank and required ancillary equipment parts warranty of 10 years, including all parts required for complete repair and/or redeployment. The warranty will remain in force through freeze solid events that could occur by any means. If the company liable for the ice storage tank offering, either manufacturer or broker, has been in business for a time period shorter than the length of the warranty period (10 years), a “Warranty Certificate” from a third-party warranty program is required. The certificate must come from a company that has been in the product warranty business for over 20 years and include the scope and length of the specified warranty. The warranty must include complete repairs of freeze solid events (total freezing of all of the water in the tanks) and remain in force after redeployment (moving the tanks to a new location) during the describe warranty period.

1.10 ICE TANK HEAT EXCHANGER WARRANTY (internal tank components)

A. Manufacturer of ice tanks must provide complete parts warranty for ice tank heat exchanger (internal tank components) and ice inventory meter and/or ice thickness meter for 5 YEARS from date of shipment to job site.

B. A *warranty certificate of authenticity* must be provided from the manufacturer at time of submittal specifically mentioning the ice tank heat exchanger parts and labor warranty of 10 years including all parts and labor required for complete repair. The warranty will remain in force through freeze solid events that could occur by any means. If the company liable for the ice storage tank offering, either the manufacturer or broker, has been in business for a time period shorter than the length of the warranty period (10 years), a “Warranty Certificate” from a third party warranty program that has been in the product warranty business for over 20 years shall be provided.

C. It shall include the scope and length of the specified warranty and specify coverage of freeze solid events, 90 psi rating, sediment blockage, and coverage if the tanks are redeployed to a new location.

D. This limited parts warranty against manufacturing defects does not cover acts of God or misuse of the equipment. Access to the tanks must be provided to allow for service. Heat transfer fluid (glycol) disposal and make-up, if required, are not covered in this warranty.

Ice Energy Storage System Performance

CHILLER AND ICE TANK MINIMUM PERFORMANCE
ARI GUIDELINE T 2002

CHILLER COOLING MODE

Chiller capacity @ (system design temp.),	
25% glycol, 95 deg. F. Ambient	____ tons
Chiller efficiency at above conditions	____ kw
Chiller glycol flow, cooling mode	____ gpm

CHILLER ICE MAKING MODE

Chiller capacity @ (average ice making temp.)	
25% glycol, 80 deg. F. Ambient	____ tons
Chiller efficiency at above conditions	____ kw
Chiller flow, ice making	____ gpm

ICE TANK STORAGE FARM

Total Usable latent storage @ 50 deg. F. ent. / 42 deg. F. lvg.,	
25% glycol, 8 hours	____ tn-hrs
Ice making hours	____ hours
Average ice making glycol temperature minimum	____ deg F
Minimum ice making glycol temperature	
(last hour of charging)	____ deg F
Number of CALMAC Modules	____ modules
Model and Number of CALMAC tanks required	____ tanks

OPC System, chillers and tanks, must perform with the above minimum efficiencies and in accordance with the attached twenty-four-hour system profile.

To avoid chiller surging and to keep energy consumption as low as possible Ice Energy Storage Systems with lower ice making temperatures will not be accepted! Ice storage manufacturer must add surface area to increase system ice making temperature to comply with the above minimum system performance standards

Ice Energy Storage System Performance Specification

(Page 3 of CALMAC IcePick Selection Program See example next page)

SYSTEM TWENTY-FOUR HOUR DAILY PROFILE

HOUR & PD TYPE	LOAD TONS	CHLR TONS	STRG TONS	TANK TONS	TN-HRS TOTAL	TN-HRS/ TANK	REQD % CHRG	AVLB CHLR TEMP	STRG TEMP	GPM MIN TEMP	RET TEMP	PER TANK PSI
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												

Tank model number: _____
Number of tanks required: _____
Hour type:
- I - Ice making hour
- P- Partial storage hour
- F- Full storage hour

Example Design Day Ice Energy Storage System Analysis

Kohl's-Fallbrook Center, LA CA 1 5/3/02

DESIGN DAY SYSTEM ANALYSIS

CHILLER UPSTREAM - SERIES FLOW	NOMINAL CHILLER SIZE = 193.1
SYSTEM SUPPLY TEMPERATURE (F) = 40.0	NUMBER OF TANKS = 3 MODEL 1500
SYSTEM RETURN TEMPERATURE (F) = 51.3	PERCENT ETHYLENE GLYCOL = 25.0
FLOW (GPM) : DISCHARGE = 450	DELTA P (PSI) : DISCHARGE = 6.9
CHARGE = 450	CHARGE = 7.7
	AVAILABLE UNUSED ICE (TONHRS) = 439

HOUR & TYPE	LOAD TONS	CHLR TONS	STRG TONS	TANK TONS	TONHRS TOTAL	TONHRS PER TANK	% CHRG	CHLR TEMP	REQD STRG TEMP	AVLB MIN TEMP	RTRN TEMP	GPM PER TANK	PD PSI	F L G
1 I	0	142.4	142.4	47.5	406	135.5	23.8	23.6	31.7	31.7	31.7	150.0	7.7	
2 I	0	142.4	142.4	47.5	549	182.9	32.1	23.5	31.6	31.6	31.6	150.0	7.7	
3 I	0	142.4	142.4	47.5	691	230.4	40.4	23.4	31.5	31.5	31.5	150.0	7.7	
4 I	0	142.4	142.4	47.5	834	277.8	48.7	23.1	31.2	31.2	31.2	150.0	7.7	
5 I	0	142.4	142.4	47.5	976	325.3	57.1	22.8	30.9	30.9	30.9	150.0	7.7	
6 I	0	142.4	142.4	47.5	1118	372.8	65.4	22.3	30.4	30.4	30.4	150.0	7.7	
7 P	0	0.0	0.0	.0	1118	372.8	65.4	40.0	40.0	32.0	40.0	.0	****	
8 P	0	0.0	0.0	.0	1118	372.8	65.4	40.0	40.0	32.0	40.0	.0	****	
9 P	130	130.0	0.0	.0	1118	372.8	65.4	40.0	40.0	32.0	47.4	.0	****	
10 P	146	146.0	0.0	.0	1118	372.8	65.4	40.0	40.0	32.0	48.3	.0	****	
11 P	160	160.0	0.0	.0	1118	372.8	65.4	40.0	40.0	32.0	49.1	.0	****	
12 P	180	180.0	0.0	.0	1118	372.8	65.4	40.0	40.0	32.0	50.2	.0	****	
13 F	183	0.0	-183.0	-61.0	935	311.8	54.7	50.4	40.0	33.4	50.4	91.5	3.7	
14 F	192	0.0	-192.0	-64.0	743	247.8	43.5	50.9	40.0	34.8	50.9	101.7	4.2	
15 F	200	0.0	-200.0	-66.7	543	181.1	31.8	51.3	40.0	36.1	51.3	111.9	4.7	
16 F	192	0.0	-192.0	-64.0	351	117.1	20.5	50.9	40.0	37.1	50.9	118.5	5.1	
17 F	180	0.0	-180.0	-60.0	171	57.1	10.0	50.2	40.0	37.7	50.2	122.1	5.3	
18 F	171	0.0	-171.0	-57.0	0	.1	0.0	49.7	40.0	38.5	49.7	130.5	5.8	
19 P	154	154.0	0.0	.0	0	.1	0.0	40.0	40.0	32.0	48.7	.0	****	
20 P	142	142.0	0.0	.0	0	.1	0.0	40.0	40.0	32.0	48.0	.0	****	
21 P	0	0.0	0.0	.0	0	.1	0.0	40.0	40.0	32.0	40.0	.0	****	
22 P	0	0.0	0.0	.0	0	.1	0.0	40.0	40.0	32.0	40.0	.0	****	
23 I	0	121.7	121.7	40.6	122	40.6	7.1	25.0	31.8	31.8	31.8	150.0	7.6	
24 I	0	142.4	142.4	47.5	264	88.0	15.4	23.7	31.8	31.8	31.8	150.0	7.7	

TANK DISCHARGE DATA

HOUR	TYPE	TONS /TANK	INLET TEMP(F)	OUTLET TEMP(F)	% TANK DISCH	TONHRS DISCH	OUT OF RANGE
8	P	42.8	48.8	40.0	7.5	42.80	
9	P	30.3	47.4	40.0	12.8	73.10	
10	P	17.8	46.0	40.0	15.9	90.90	
11	P	30.3	47.4	40.0	21.3	121.20	
12	P	42.8	48.8	40.0	28.8	164.00	
13	F	61.0	50.4	40.0	10.7	61.00	
14	F	64.0	50.9	40.0	21.9	125.00	
15	F	66.7	51.3	40.0	33.6	191.67	
16	F	64.0	50.9	40.0	44.9	255.67	
17	F	60.0	50.2	40.0	55.4	315.67	
18	F	57.0	49.7	40.0	65.4	372.67	

END OF SECTION 23 71 00

SECTION 23 73 13
AIR HANDLING UNITS, CENTRAL STATION, MODULAR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install modular central station air handling units of the types, sizes, and capacities indicated.

1.3 RELATION TO OTHER WORK

A. Refer to the section "General Mechanical Provisions" for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the drawings and specifications.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Include complete performance data at the scheduled operating conditions; dimensions; weights; fan performance curves, airside pressure losses; waterside pressure losses; water quantities; coil descriptions; and unit inlet, discharge and radiated sound power levels, by octave bands, at the stated conditions; and a complete schedule worked up by unit number.

1.5 CERTIFICATION

A. Equipment performance ratings shall be certified as follows:

1. Fans: AMCA Bulletin 210 or ARI Standard 430.
2. Coils: ARI Standard 410.

1.6 MANUFACTURER

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Trane
2. Carrier
3. Temtrol

PART 2 - PRODUCT

2.1 GENERAL

A. Units shall be configured of standard modules arranged in sequence in direction of air flow as required to meet project requirements. Modules shall generally include, but not be limited to, the following as applicable to each air handling unit's individual requirements:

1. Intake module.
2. Mixing/Filter-Mixing Box module.
3. Filter module(s).
4. Inspection and/or access module(s).
5. Coil module(s).
6. Fan module.
7. Discharge plenum module(s).
8. Diffuser module.
9. Internal or external face and bypass module.
10. Multizone or double-duct coil section.

Modules shall comply with the requirements of the following component descriptions as appropriate to the configuration of the individual module.

B. Unit layout and configuration shall be as defined in project plans and schedule.

C. Provide unit mounting legs to support all sections of unit and raise unit for proper trapping. Contractor will be responsible for providing a housekeeping pad when unit mounting device is not of sufficient height to properly trap unit. Unit mounting devices not constructed of galvanized steel shall be chemically cleaned and coated with both a rust-inhibiting primer and finished coat of rust-inhibiting enamel.

2.2 MODULE CASINGS

A. Unit shall be constructed of a complete structural frame with removable panels. Unit manufacturer shall ship separate segments so unit can be broken down for ease of installation in tight spaces. The entire air handler shall be constructed of galvanized steel. Casing finished to meet ASTMB 117 250-hour salt-spray test. The removal of side panels shall not affect the structural integrity of the unit. All removable panels shall be gasketed to minimize air leakage. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit.

B. Construct casing sections capable of operating from -4"wg to +6"wg.

C. Hinged access doors shall be available in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance. At a minimum, doors shall be provided in filter, upstream of cooling coil, downstream of cooling coil and fan sections. Removable access panels in lieu of doors are not acceptable.

D. Access doors shall be double wall construction to prevent damage to insulation during routine maintenance.

E. Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of all interior surfaces.

F. Door hardware shall be surface mounted to minimize penetrations in the door casing that could lead to air leakage paths.

G. All joints between exterior panels and structural frames, as well as joints between module frames, shall be properly sealed and gasketed to provide an air seal.

H. Panels shall be double-wall construction to facilitate cleaning of the unit interior. The interior wall shall be constructed of solid, galvanized steel. Thermal resistance (R-value) shall be 8.33 ft2-hr-F/BTU or better.

2.3 FANS

A. Provide fans of type and class as specified on the schedule. Fan shafts shall be solid, coated with a rust-inhibiting coating, and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. All fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at the operating RPM to meet design specifications. Fans controlled by variable frequency drives shall be statically and dynamically tested for vibration and alignment at speeds between 25% and 100% of design RPM. If fans are not factory-tested for vibration and alignment, the contractor shall be responsible for cost and labor associated with field balancing and certified vibration performance. Fan wheels shall be keyed to fan shafts to prevent slipping.

B. Provide grease lubricated ball bearings selected for L-50 200,000-hour average life per ANSI/AFBMA 9. Greasable bearings shall have lubrication lines extended to the drive side of the unit. Lubrication lines shall be a clear, high-pressure, polymer to aid in visual inspection. Extend both grease lubrication lines to drive side of unit and rigidly attach to drive side bearing support with zerk fittings. If extended lubrication lines are not provided, manufacturer shall provide permanently lubricated bearing with engineering calculations for proof of bearing life.

C. Fans shall be mounted on isolation bases. Internally-mounted motor shall be on the same isolation base. Fan and motor shall be internally isolated with spring isolators. Flexible canvas ducts shall be installed between fan and unit casing to ensure complete isolation. Flexible canvas ducts shall comply with NFPA 90A and UL 181 requirements.

D. Fan modules shall have a access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components. Construct door(s) per Section 2.03 paragraphs D, E, and F.

E. Fans for VAV applications shall be factory inverter duty balanced prior to shipment.

2.4 MOTORS AND DRIVES

A. All motors and drives shall be factory-installed and run tested. All motors shall be installed on a slide base to permit adjustment of belt tension. Slide base shall be designed to accept all motor sizes offered by the air-handler manufacturer for that fan size to allow a motor change in the future, should airflow requirements change. Fan sections without factory-installed motors shall have motors field installed by the contractor. The contractor shall be responsible for all costs associated with installation of motor and drive, alignment of sheaves and belts, run testing of the motor, and balancing of the assembly.

B. Fan Motors shall be heavy duty, open drip-proof, E+.

C. Motors shall be selected to operate continuously at 104 F (40 C) ambient without tripping of overloads. Motors shall have a +/- 10 percent voltage utilization range to protect against voltage variation. Motors shall be in compliance with EPACT when applicable.

D. V-Belt Drive shall be fixed pitch rated at 1.5 times the motor nameplate.

E. Manufacturer shall provide for each fan a nameplate with the following information to assist air balance contractor in start up and service personnel in maintenance:

1. Fan and motor sheave part number
2. Fan and motor bushing part number
3. Number of belts and belt part numbers
4. Fan design RPM and motor HP
5. Belt tension and deflection
6. Center distance between shafts

2.5 COILS

A. Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drainpan under the coil.

B. Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.

C. Construct coil casings of stainless steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.

D. All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.

E. On stacked cooling coils, intermediate stainless steel drain pans shall be installed between the coils. Intermediate drain pans shall have drop tubes to guide condensate to the main drain pan, thus preventing flooding of lower coils that would result in moisture carryover.

F. Where indicated on the schedule coils shall be provided with a factory applied heresite corrosion protection coating. Manufacture shall guarantee no moisture carryover when coating is applied. Field applied coating is unacceptable.

G. Hydronic Coils:

1. Supply and return header connections shall be clearly labeled on outside of units such that direction of coil water-flow is counter to direction of unit air-flow.
2. Coils shall be proof tested to 300 psig and leak tested to 200 psig air pressure under water.
3. Headers shall be constructed of round copper pipe or cast iron.

4. Tubes shall be 1/2 inch O.D. or 5/8" O.D minimum .016 inch thick copper. Fins shall be aluminum.

2.6 BASE-LEVEL DRAIN PANS

A. Insulation shall be encased between exterior and interior walls. Units with cooling coils shall have stainless steel drain pans under complete cooling coil section that extend beyond the air-leaving side of the coil to ensure capture of all condensate in section. Cooling coil drain pans shall be sloped in 2 planes, pitched toward drain connections to ensure complete condensate drainage when unit is installed level and trapped per manufacturer's requirements. See section 2.05, paragraph E for specifications on intermediate drain pans between cooling coils.

B. Units with heating coils shall have a galvanized steel drain pan under complete heating coil section sloped in 2 planes and pitched toward drain connections to ensure proper drainage during cleaning and to capture water in the event of a coil failure.

C. All drain pan connections supplied by unit manufacturer including, piping, and piping connections extending from stainless steel drain pans shall be constructed of stainless steel. The contractor is responsible to ensure the unit is installed level, trapped in accordance with the manufacturer's requirements, and visually inspected to ensure proper drainage of condensate.

2.7 FILTERS

A. Provide factory-fabricated filter section(s) of the same construction and finish as unit casings. Filter section(s) shall have filter guides and access door extending the full height of the casing to facilitate filter removal. Construct doors in accordance with Section 2.03, paragraphs D, E, and F. Provide filter blockoffs as required to prevent air bypass around filters.

B. Final Filters:

Thickness:	2-inches
Efficiency:	MERV 12
Media Type:	Pleated media
Access:	Removable from one side of unit
Arrangement:	Provided as defined by the drawings.

2.8 DAMPERS

A. All dampers, with the exception of external bypass and multizones (if scheduled), shall be internally mounted. Dampers shall be premium ultra low leak and located as scheduled. Dampers shall be Ruskin CD60 double-skin airfoil design or equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 5 CFM/square foot at one inch water gauge and 9 CFM/square foot at 4 inches water gauge. All leakage testing and pressure ratings shall be based on AMCA Publication 500. Manufacturer shall submit brand and model of damper(s) being furnished.

B. Where required, provide a factory-mounted ASHRAE Standard 62 airflow monitoring and control station in the outdoor air opening of the mixing box. The monitor shall track a variable outside air quantity for ventilation demand flow control and ventilation flow documentation.

The airflow monitoring station shall be factory-mounted, factory-calibrated, and installed per the airflow monitor manufacturer's recommendations.

1. The air handling unit mixing box shall also include a modulating outside air damper mounted in series with the air flow monitor.
2. All linkages, crank arms, jack shafts and mounting hardware shall be provided.
3. The airflow monitoring station shall be calibrated to measure a variable airflow from 15% of nominal airhandler cfm up to 100% of design airflow, maintaining an accuracy of plus or minus five (5%) percent of actual cfm, for air measuring between -40F up to +158F. Monitoring station shall compensate for outside air temperature fluctuations that affect mass flow rate of air.
4. Manufacturer shall submit test data to demonstrate compliance.
5. The airflow monitoring station shall provide a proportional output velocity signal (2-10 vdc). The velocity sensor shall have an automatic zeroing function and shall be programmed to recalibrate the device's transducer a minimum of once per day to ensure continuous accuracy of airflow measurements. The monitor manufacturer shall provide to the Building Automation System (BAS) contractor a certified conversion table for the signal provided.

2.9 ACCESS SECTIONS

A. Access for inspection and cleaning of the unit drain pan, coils and fans sections shall be provided. The unit shall be installed for proper access. Procedure for proper access, inspection and cleaning of the unit shall be included in the maintenance manual. Access section shall have double wall, hinged, removable access doors on one side of sections. Construct doors per Section 2.03 paragraphs D, E, and F.

2.10 OVERALL CONSTRUCTION

A. Shall be low, medium or high pressure as recommended by the manufacturer for operation at the indicated conditions.

2.11 UNIT COMPONENTS AND CONFIGURATIONS

A. General: Refer to drawings and schedules for components and configurations of units. In general and unless exceptions are indicated, unit assemblies shall consist of the following items in series in direction of air flow:

B. Draw-through Type Units:

1. Mixing box / filter module.
2. Coil module(s).
3. Access module.
4. Plenum fan module.

2.12 CONSTRUCTION PRESSURE REQUIREMENTS

A. Each unit shall be specifically cataloged, rated and constructed for operation at the total static pressure conditions of the system in which the unit is utilized and shall be recommended by the manufacturer for the specific pressure and operating conditions encountered on this project.

2.13 OTHER REQUIREMENTS

A. Units shall be horizontal or vertical configuration (as applicable).

B. Cooling coils shall not have face velocities in excess of 550 fpm unless otherwise indicated on drawing schedule (in such case, velocity obtained from drawing schedule shall be upper limit).

C. Units shall be provided which will perform as indicated with proper consideration of any correction factors which are applicable to unit casing configuration.

D. Heating coils shall be located in either or both the reheat and preheat positions as scheduled.

E. Pipe all coils for counterflow heat transfer.

PART 3 - INSTALLATION

3.1 EQUIPMENT PLACEMENT

A. Air handling equipment shall be located essentially as shown on drawings; however, actual placement of the unit shall be verified using field measurements and data relating to the units approved for actual installation on this project.

3.2 WIRING

A. Where units utilize internal drives, conduit penetrations shall be provided by the manufacturer. The conduit openings shall be located on the drive side and positioned so as not to compromise access to any portion of the unit. The opening shall be provided with effective seals and the edges of the internal insulation shall be properly sealed.

3.3 SOUND AND VIBRATION CONTROL

A. Refer to other sections for airside sound control and vibration control. Mount isolators using height saving brackets where required to reduce operating height of unit to suit space available.

3.4 DUCT CONNECTIONS

A. Supply and return ducts shall be connected to their respective air handler using flexible connectors. Connectors shall be properly installed so that they are not in tension and are aligned with their respective ducts.

3.5 PIPING

A. Refer to sections describing connected piping. Plug unused drain connections.

END OF SECTION 23 73 13

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SECTION 23 81 23
COMPUTER ROOM AIR CONDITIONING UNIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide complete factory packaged computer room air conditioning units with chilled water coil and direct expansion coil with air cooled condenser. Size, capacity and performance shall be as indicated in the schedule on the drawing.

1.3 RELATION TO OTHER WORK

A. Coordinate equipment ordering, delivery and placement; utility connections; and the work of all related trades.

1.4 SHOP DRAWINGS

A. Refer to section entitled "General Mechanical Provisions". Include complete information on: operating and safety controls, including microprocessor control system; operating sequence, power requirements; and power, control and interlock wiring diagrams and capacities when operating with chilled water or with direct expansion equipment.

1.5 BASIS OF DESIGN

A. Basis of design is similar to Liebert self-contained factory assembled unit with upflow air delivery.

1.6 CERTIFIED PERFORMANCE

A. Thermal and acoustical insulation shall meet the requirements of NFPA 90A. Compressor motors, starters and control wiring shall conform to NEMA, UL, NEC and Local Utility requirements. Performance shall be in accordance with ARI Standard 550.

B. Fan ratings shall comply with the latest Air Movement and Control Association (AMCA) Standards.

1.7 MANUFACTURER'S CHECKOUT

A. Start-up Service: Manufacturer shall furnish a factory-trained representative without charge for three working days. Representative shall supervise leak testing, start-up and instruction of Owner's personnel on operation and maintenance.

1.8 ACCEPTABLE MANUFACTURERS

A. Airflow Company, Climateworx or equivalent.

PART 2 - PRODUCTS

2.1 GENERAL

A. Cabinet: Factory assembled; frame constructed of heliarc welded tubular steel; exterior panels insulated with a minimum 1 inch thickness, 1-1/2 lbs. density fiberglass; panels removable for service access with concealed fasteners; panels arranged to provide access to the electrical control panel and compressor section without interrupting the air flow; paint color selected by Architect.

B. Fan Section: Centrifugal type; double width; double inlet; statically and dynamically balanced as completed assembly; maximum vibration level of two mils in any plane; steel shaft with self-aligning ball bearings; motor mounted on adjustable slide base; v-belt drive; draw through cooling coil. Refer to paragraph entitled "V-BELT DRIVE" in Section 23 05 00.

C. Filter: Filter holding frame located within cabinet; serviceable from either end of unit; high efficiency throwaway type; rated not less than 35% efficiency. For filter type refer to Section 23 41 00, AIR FILTER ASSEMBLIES.

2.2 REFRIGERATION SYSTEM

A. Dual Circuiting: Each refrigeration circuit shall include hot gas mufflers, liquid line filter dryers, refrigerant sight glass with moisture indicator; adjustable, externally equalized expansion valves, and liquid line solenoid valves.

B. Semi-Hermetic Compressors: The compressors shall be located in a separate compartment so they may be serviced during operation of the equipment. The compressor shall be semi-hermetic with a suction gas cooled motor, vibration isolators, thermal overloads, oil sight glass, manual reset high pressure switch, pump down low pressure switch, suction line strainer, reversible oil pumps for forced feed lubrication and a maximum operating speed of 1750 rpm.

2.3 AIR-COOLED CONDENSER

A. General: Air cooled condenser shall be the horizontal discharge, slow speed, multiple v-belt drive centrifugal fan type. The condenser shall have two separate refrigeration circuits to balance the heat rejection of each compressor at 100 degree F. ambient. The condenser shall be constructed of reinforced steel and contain a copper tube, aluminum fin coil.

B. Winter Control System: The winter control system for the air cooled condenser shall allow start-up and positive head pressure control with ambient temperatures as low as -30 degree F. The package shall include the insulated and heated receivers, pressure relief valves for each circuit, head pressure three-way control valves, and valves for isolating the refrigerant charge. The winter control system shall be factory prepiped, insulated, and mounted ready for the field connection to the unit.

C. Fan Section: Fan shall be centrifugal type, double width, double inlet and shall be statically and dynamically balanced at the factory. The fan shall be driven by a 1750 rpm motor mounted on an adjustable slide base.

D. Head Pressure Control: The control system shall be complete with transducers, thermostats and electrical control circuit, factory pre-packaged in the integral condenser control box. The transducer shall automatically sense the highest head pressure of either operating compressor and control the fan on the air cooled condenser to properly maintain the head pressure.

2.4 COOLING COIL

A. Chilled Water Coil: Chilled water cooling coil 2-way modulating valve. Microprocessor shall position the valve in response to room conditions. Cooling capacity will be controlled by modulating the chilled water. The modulating valve's travel for dehumidification shall be proportional. The cooling coil shall be constructed of copper tubes and aluminum fins. The entire coil assembly shall be mounted in a stainless steel condensate drain pan.

B. Direct Expansion Coil: The A-frame evaporator coil shall be constructed of copper tubes and aluminum fins and have a maximum face velocity of 350 ft. per minute and be not less than 4 rows deep. Refrigerant of each system shall be distributed throughout the entire coil face area. A stainless steel condensate drain pan shall be provided.

2.5 CONTROL PANEL

A. Electronic control system shall be totally solid state. The system shall be provided with Start button, Stop button, Silencer button, Temporary Loss of Power indicator, manual reset circuit breakers, plug-in solid state temperature control with sensitivity adjustment, plug-in solid state humidity control, and backlighted monitor panel.

B. Backlighted monitor panel shall have the following visual indicators:

1. Cooling on Dehumidification
2. Heating Stage 1, 2 & 3
3. Change Filters
4. Humidification

C. Solid state temperature and humidity control each shall have one adjusting sensing point for the room conditions. The temperature and humidity controls shall have a "push-to-test" calibration check button and built in visual indicators to indicate the mode of operation of the control. All controls and control sensors shall be easily accessible.

D. Each high voltage circuit in the system shall be individually protected by a dual element fuse. All starters, contactors and relays shall be controlled by a 24 volt control circuit. All high voltage components shall be protected by a safety lock dead front panel.

E. Provide panel to include a solid state plug-in module, silencer switch, individual red indicators for each function to be monitored, and an audible alarm. The following alarm conditions shall be provided: high and low temperature and humidity, loss of air flow, change filter, high and low humidifier water level, manual override, water under floor, loss of water flow, loss of power and main fan overload. Provide a set of dry contacts for connection to the Control System as required by Division 17.

F. Microprocessor Control System:

1. The control system shall be microprocessor based. The system shall be provided with LED numerical display to allow observation of room temperature and humidity and each function (temperature setpoint, temperature sensitivity, humidity setpoint, humidity sensitivity). Normal operating modes (heating, cooling, humidification, dehumidification) shall be indicated by colored LEDs on the unit-mounted display panel.
2. The control system shall monitor unit operation and activate an audible and visual alarm in the event the following factory preset alarm conditions:

    a. High temperature
    b. Low temperature
    c. High humidity
    d. Low humidity
    e. High head pressure
    f. Change filters
    g. Loss of air
    h. Humidifier problem
    i. Field accessible local alarm
    j. Manual override activated

3. A compressor sequence switch shall be provided to change the lead/lag sequence of the compressors.

G. Accessories to be Included:

1. Firestat: The firestat shall immediately shut down the environmental control system when activated. The firestat shall be mounted in the electrical panel with the sensing element in the return air.
2. Disconnect Switch (Locking Type): The non-automatic molded case circuit breaker shall be mounted in the high voltage section of the electrical panel. The switch shall be accessible from the outside of the unit with the access panel closed, and prevent access to the high voltage electrical components until switched to the "OFF" position.

2.6 REHEAT COIL

A. Electric: Heavy duty; low watt density; fin tubular construction; sufficient capacity to maintain room dry bulb conditions when the system is calling for dehumidification; multiple stage control; installation UL approved with all safety and operating controls; disconnect switch. Coil capacity and the number of stages are specified in schedule on drawing.

2.7 HUMIDIFIER

A. General: Located in bypass air to prevent over-humidification; field adjustable flush control system to change the cycle time in accordance with local water conditions; humidifier capacity specified in the schedule on drawing.

B. Infra-red: Infra-red type consisting of high intensity quartz lamps mounted above and out of the water supply; stainless steel evaporator pan; serviceable for cleaning without disconnecting water supply lines, drain lines or electrical connections; liquid level control; emergency overflow; prepiped ready for final connection with primary water supply from cooling coil condensate.

PART 3 - EXECUTION

3.1 PLACEMENT AND MOUNTING

A. Installed units shall be free of vibration and shall not produce excessive noise within the occupancy area of the building.

B. Layout and carefully install units with sufficient clearances to permit proper maintenance.

C. Coordinate with piping, ductwork, starters, electrical connections and controls for a neat workmanlike installation.

D. The computer room air conditioning unit shall be furnished for the electrical voltage and phase indicated in the schedule on the drawings. Verify the circuit voltage and phase indicated on the electrical drawings prior to submitting shop drawings.

3.2 INSTALLATION

A. Layout exact location for air cooled condensers structural bases, and furnish to Contractor a dimensional drawing showing base sizes and locations including sleeve location for the refrigerant piping.

B. Install computer room air conditioning units and air cooled condensers and make refrigerant piping connections and electrical connections in accordance with the manufacturer's recommendations.

3.3 LUBRICATION

A. Provide initial charge of lubricating oil for all equipment furnished. Before system is finally accepted by Owner, drain oil from equipment and replace with new charge. Furnish Owner chart stating type oil and schedule of maintenance to be used for various equipment.

3.4 REFRIGERANT

A. Provide all refrigerant required to develop system to full rating. Guarantee that loss of refrigerant for first twelve month period not to exceed ten percent (10%) of full charge of system, and provide refrigerant required if this amount is exceed in addition to correcting cause of refrigerant loss.

B. Refrigerant piping shall be installed with the air cooled condensers above the location of the compressors.

3.5 DUCT CONNECTIONS

A. Supply and Return: Ducts shall be connected to their respective units with flexible connectors. Refer to paragraph entitled "FLEXIBLE DUCT CONNECTIONS" in Section 23 33 00.

END OF SECTION 23 81 23

SECTION 23 81 26
CONDENSING UNITS: AIR COOLED HERMETIC

PART 1 - GENERAL

1.1 SCOPE

A. Provide packaged hermetic air cooled condensing units of the capacity, operating characteristics, and electrical characteristics indicated on drawings and specified herein.

1.2 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Include complete data on: unit dimensions; minimum operating and service clearances; capacities and rating conditions; maximum operating weights; power consumption; power and control wiring (both factory and field); and operating and safety controls.

1.3 MANUFACTURER

A. Design Basis: Trane TTA Series or as otherwise scheduled.

B. Acceptable: Carrier, Trane, Weatherking, York or equal.

1.4 COMPATIBILITY

A. Each unit must be compatible with evaporator coil arrangements and associated controls to which connected equipment is interfaced.

PART 2 - PRODUCTS

2.1 FRAME

A. Unit shall be completely factory assembled with all components mounted on a steel frame.

2.2 FINISH

A. The frame, all structural members, and sheet metal panels shall be properly cleaned, painted with a zinc rich primer, and finished with alkyd enamel.

2.3 COMPRESSOR AND MOTOR

A. The unit compressor(s) shall be of the hermetic reciprocating type with crankcase heater.

B. Motor shall be suction gas cooled and sized for continuous operation over the full range of operating conditions indicated and with voltage variations indicated in the National Electric

Code. Motor running protection shall be provided by temperature sensors embedded in the motor windings and by thermal overload relays.

2.4 CONDENSER

A. Seamless copper tubes with mechanically bonded aluminum fins.

2.5 CONDENSER FANS

A. Direct drive, propeller type with fan guards. Fan motors shall have thermal overload relays for running protection.

2.6 FACTORY PREWIRING

A. Unit shall be factory wired with power connections brought out to a single set of terminal lugs for field connection.

PART 3 - EXECUTION

3.1 UNIT PLACEMENT

A. The unit location shall be essentially as shown on drawings; however, actual placement shall be verified using field measurements and data relating to the equipment approved for actual installation on this project.

3.2 COORDINATION

A. Refer to Sections describing refrigerant piping systems and air handling units with DX refrigerant coils. Provide all piping, hangers, supports, valves, and specialty items as required for a complete and operable system.

3.3 VIBRATION CONTROL

A. Refer to Section entitled "Vibration Isolation" for vibration control.

3.4 TEST AND BALANCE

A. Refer to Sections describing tests and balancing.

END OF SECTION 23 81 26

SECTION 23 81 27
AIR HANDLING UNITS, SPLIT SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Furnish and install medium duty factory packaged air handling units with direct expansion refrigerant coils of the types, sizes, and capacities indicated.

1.2 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Include complete performance data at the scheduled operating conditions, dimensions; weights; fan performance curves, airside pressure losses; waterside pressure losses; coil descriptions; and fan discharge and radiated sound power levels, by octave bands, at the stated conditions.

1.3 CERTIFICATION

A. Equipment performance ratings shall be certified as follows:

1. Fans: AMCA Bulletin 210 or ARI Standard 430.
2. Coils: ARI Standard 210-79.

1.4 MANUFACTURER

A. Basis of design: Similar to Trane Series TWE or Climate Changer Series, or as scheduled on the drawings.

B. Acceptable: Carrier, Trane, York, Weatherking.

1.5 COMPATIBILITY

A. Each unit must be compatible with the condensing units(s) to which it is matched. This includes unit arrangement/configuration, capacity, associated controls, piping and all other connected equipment to which the unit and its components are interfaced.

PART 2 - PRODUCTS

2.1 CASING

A. Unit casings shall be fabricated of mill galvanized steel reinforced with formed "hat" channels or steel angle iron frames and bracing to provide a rigid assembly. Casing shall be provided with removable panels for access to and removal of coils, dampers and fans in external units. Provide hinged access door for access to and removal of fans and drives in internal drive units.

2.2 DRAIN PAN

A. Unit drain pan shall be of the double wall internally insulated type with welded seams. Drain pan in draw-thru units shall extend under both the fan and coils sections and in blow-thru units under the entire coil and plenum section.

2.3 DIRECT EXPANSION REFRIGERANT COOLING COILS

A. Provide direct expansion refrigerant cooling coil of copper tubes with aluminum fins mechanically bonded thereto, circuited to provide proper refrigerant velocities, properly matched with compressor-condenser assembly for proper operation, with expansion valves selected for optimum refrigerant flow from 20% to 100% full load.

2.4 ELECTRIC HEATING COILS

A. Where electric heating coils are shown or scheduled to be integral with the air handling unit, each such coil shall be as follows:

1. Factory assembled and prewired. Heater capacities, sizes and operating characteristics shall be as scheduled on drawings or as indicated in other sections.
2. Meet all applicable requirements of the current NEC.
3. UL listed including all built-in components.
4. Coordinated with the specified requirements of the mechanical system control system.
5. Provided in capacity control steps indicated or scheduled. If not otherwise indicated, heaters over 10 KW shall have heating elements sequenced on and off in 5 KW increments, and shall be wired for 2 stage operation. All heaters shall be equipped with both thermal and current overload devices, and the required heating and cooling system controls.

2.5 FANS

A. Fans shall be individually selected to best suit the air quantities and pressures scheduled. Fans handling less than eighteen thousand (18,000) cubic feet per minute, at four and one-half (4-1/2) inches or less static pressure may be of the forward curved blade centrifugal type. Fans handling eighteen thousand (18,000) cubic feet per minute or more or operating at more than four and one-half (4-1/2) inches static pressure shall be of the backward inclined airfoil blade centrifugal type. All fans shall be double width, double inlet type. Fans and shafts shall be selected to operate not less than twenty-five percent (25%) below their first critical speed, statically and dynamically balanced, and keyed to the shafts. Shafts shall be of the hollow large diameter type with tapered and strengthened ends where they extend entirely through the casing and shall be solid steel for fans having drives within the casing. Shafts shall be turned and shall be ground and polished at bearing and fan mounting points.

2.6 BEARINGS

A. Provide regreaseable ball types selected for an average life of 200,000 hours at design operating conditions. Bearings shall have grease line extended to the drive side of the fan casing of the drive side of the fan scroll for internal drive fans.

2.7 DRIVES AND MOTORS

A. Provide guards for internal and external drive fans.

2.8 INSULATION

A. The entire air handling unit casing (including accessory sections), including structural frame and channels shall be insulated from contact with the air stream. Insulate using one inch (1") thick, three (3) pound per cubic foot density fiberglass duct liner having a neoprene stabilized face toward the air stream. The insulation shall be secured using a full coverage insulation and adhesives shall comply with the requirements of NFPA 90A as to flame spread and smoke developed ratings.

2.9 FILTERS

A. See section describing air filters.

2.10 OVERALL CONSTRUCTION

A. Shall be as recommended by the manufacturer for operation at the indicated conditions.

2.11 OTHER REQUIREMENTS

A. Be horizontal or vertical configuration (as applicable).

B. Cooling coils shall not have face velocities in excess of 500 fpm unless otherwise indicated on drawings schedule (in such case, velocity obtained from drawings schedule shall be upper limit).

C. Units shall be provided which will perform as indicated with proper consideration of any correction factors which are applicable to system unit casing configuration.

D. Heating coils, if required, shall be located in reheat position unless otherwise indicated.

PART 3 - INSTALLATION

3.1 EQUIPMENT PLACEMENT

A. Air handling equipment shall be located essentially as shown on drawings; however, actual placement of the unit shall be verified using field measurements and data relating to the units approved for actual installation on this project.

3.2 WIRING

A. Where units utilize internal drives, conduit penetrations shall be provided by the manufacturer. The conduit openings shall be located on the drive side and positioned so as not to compromise access to any portion of the unit. The opening shall be provided with effective seals and the edges of the internal insulation shall be properly sealed.

3.3 SOUND AND VIBRATION CONTROL

A. Refer to other sections for airside sound control and vibration control. Mount isolators using height saving brackets where required to reduce operating height of unit to suit space available.

3.4 DUCT CONNECTIONS

A. Supply and return ducts and combination filter mixing boxes shall be connected to their respective air handler using flexible connectors. Connectors shall be properly installed so that they are not in tension and are aligned with their respective ducts.

3.5 HOUSEKEEPING PAD

A. Provide 6 inch high reinforced concrete (with 10 x 10 WWP) housekeeping pad for each floor mounted unit. The housekeeping pad shall extend 6 inches beyond the unit base in all directions and shall be continuous beneath the base. Pads shall have chamfered edges and shall be poured and finished smooth and level.

3.6 OTHER REQUIREMENTS

A. Properly connect all piping.

B. Allow adequate space for all service and operational clearances necessary.

END OF SECTION 23 81 27

SECTION 23 81 31
DUCTLESS SPLIT-SYSTEM AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes ductless split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for fully exposed or partially concealed mounting, and may be connected to small branch and outside air ducts.

1.2 SUBMITTALS

A. Product Data: For each unit indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace split-system air-conditioning units that fail in materials and workmanship within the following specified number of years from date of Substantial Completion:

1. Entire unit: 1 year parts and labor.
2. Compressor: 5 years parts.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Basis of design: Enviro Master International Corp. (EMI)
2. Carrier Air Conditioning; Div. of Carrier Corp.
3. Mitsubishi Electronics America, Inc.; HVAC Division.
4. Sanyo Fisher (U.S.A.) Corp.
5. Daikin.

2.2 EVAPORATOR-FAN UNIT

A. Exposed, Wall Mounted Unit Cabinet: Fabricated of cold roll steel with structural stiffness.

1. Insulation: Faced, glass-fiber duct liner.
2. Drain Pans: Galvanized steel, with connection for drain; insulated.
3. Intake Grille: High impact polystyrene air inlet panel.
4. Discharge Grille: High temp noryl.
5. Evaporator Fan: Tangential type.

B. Partially Concealed Ceiling Mounted Unit Cabinet:

1. Chasis: Galvanized steel.
2. Fascia: High impact polystyrene.
3. Drain Pans: Galvanized steel, with connection for drain; insulated.
4. Evaporator Fan: Backward curved centrifugal.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

D. Electric Coil: Helical, nickel-chrome, electric-resistance heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.

E. Fan Motor: Multispeed.

F. Filters: Permanent, electrostatic, cleanable.

G. Condensate Pump: Where scheduled.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER UNIT

A. Casing steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed reciprocating or scroll type with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 45 deg F.

H. Mounting Base: Polyethylene.

I. Where multizone units are specified, each compressor and circuit shall be sized properly for each evaporator.

2.4 ACCESSORIES

A. Thermostat: Provide with optional remote. Low voltage with subbase to control compressor and evaporator fan.

B. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

C. Infrared Control: Provide with factory infrared controls and remote operator.

D. Time Delay: Provide with short cycle time delay.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

B. Install ground-mounted, compressor-condenser components on 4-inch- thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

C. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

D. Install roof-mounted, compressor-condenser components on equipment supports equal to Pate ER. Anchor units to supports with removable, cadmium-plated fasteners.

E. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch.

3.2 CONNECTIONS

A. Connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

B. Connect supply and return water coil with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.

C. Connect supply and return condenser connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.

D. Install piping adjacent to unit to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.

B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 23 81 31

Division 26

Electrical

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SECTION 26 01 00
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section specifies the basic requirements for electrical installations and includes requirements common to all sections of Division-26. It expands and supplements the requirements specified in sections of Division-01.

1.3 CODES AND STANDARDS

A. Install all work in accordance with the applicable requirements of the latest edition of the following:

1. National Electric Code (NEC)
2. Local, State, County and City Codes
3. National Fire Protection Association (NFPA)
4. American National Standards Institute (ANSI)
5. NEMA Standards

B. It is the intent of the Contract Documents to comply with the applicable codes, ordinances, regulations, and standards. Where discrepancies occur, notify the Architect in writing, and ask for interpretation. Correct any installation that fails to comply with the applicable codes and standards at no additional cost to the Owner.

C. All materials shall be new and free of defects, and shall be U.L. listed, bear the U.L. label or be labeled or listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.

1.4 PERMITS AND INSPECTIONS

A. Obtain and make all payments for permits and inspections required. At the completion of the project and before final acceptance of the electrical work, provide evidence of final inspection and approval by the authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical products specified, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 5 years of successful installation experience on projects with electrical work similar to that required for this project.

1.6 IDENTIFICATION

A. The following items shall be equipped with nameplates: All new switchboards, panelboards, circuit breakers, and transformers.

B. Nameplates shall adequately describe the function of the particular equipment involved. Nameplates for panelboards and switchboards shall include the panel designation, branch (normal), voltage and phase of the supply. For example, "Panel A, Normal Branch, 480Y/277V, 3-phase, 4-wire."

C. Nameplates shall be laminated phenolic plastic, black front and back with white core, with 3/8" high lettering etched through the outer covering. White engraved letters on black background. Attach with plated self-tapping screws or brass bolts.

D. Provide nameplates on all existing equipment that a circuit under this contract is fed from.

E. All junction box covers shall be hand marked with a 1/8" wide permanent black marking pen, indicating panel and circuit numbers contained, or system contained, i.e., fire alarm, telephone, etc.

1.7 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected, and architectural room elevations.

1.8 ELECTRICAL INSTALLATIONS

A. Coordinate electrical equipment and materials installation with other building components.

B. Verify all dimensions by field measurements.

C. Arrange for chases, slots, and openings in other building components to allow for electrical installations.

D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

E. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

F. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.

G. Coordinate connection of electrical systems with local utility services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connections for each service.

1.9 CUTTING AND PATCHING

A. This Article specifies the cutting and patching of electrical equipment, components, and materials to include removal and legal disposal of selected materials, components, and equipment.

B. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

C. Arrange for repairs required to restore other work, because of damage caused as a result of electrical installations.

D. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

E. Perform cutting, fitting, and patching of electrical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed work;
2. Remove and replace defective Work;
3. Remove and replace Work not conforming to requirements of the Contract Documents;
4. Remove samples of installed Work as specified for testing;
5. Upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
6. Install electrical work in existing facilities.

1.10 ELECTRICAL SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary) and Division-01 Section: SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES for submittal definitions, requirements, and procedures.

B. Submittal of shop drawings, product data, and samples will be accepted only when submitted by the Contractor. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed.

1.11 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders and the Division-01 for requirements in selecting products and requesting substitutions. Where a listing of acceptable manufacturers has been given, use one of those manufacturers given only.

1.12 PRODUCT LISTING

A. Prepare listing of major electrical equipment and materials for the project.

B. Provide all information requested.

C. Submit this listing as a part of the submittal requirement specified in Division-01.

D. When two or more items of the same material or equipment are required they shall be of the same manufacturer, i.e., panelboards, motor starters, transformers, etc. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated.

E. Provide products which are compatible within systems and other connected items.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.14 RECORD DOCUMENTS

A. Refer to the Division-01 Section: PROJECT CLOSEOUT or PROJECT RECORD DOCUMENTS for requirements. The following paragraphs supplement the requirements of Division-01.

B. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details.

C. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

1.15 OPERATION AND MAINTENANCE DATA

A. Refer to the Division-01 Section; PROJECT CLOSEOUT or OPERATION AND MAINTENANCE DATA for procedures and requirements for preparation and submittal of maintenance manuals.

1.16 WARRANTIES

A. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division-26, into a separate set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.17 CLEANING

A. Refer to the Division-01 Section; PROJECT CLOSEOUT or FINAL CLEANING for general requirements for final cleaning.

B. Clean all light fixtures, lamps and lenses prior to final acceptance. Replace all inoperative lamps.

1.18 TEMPORARY POWER

A. Provide and pay for all temporary electrical service if required for construction.

B. Provide all temporary lighting and power distribution as required for construction. All temporary electrical work shall be in accordance with the N.E.C.

1.19 ELECTRONIC FILES

A. CADD files will be available on a limited basis to qualified firms at the Architects prerogative. Recipients are cautioned that these files may not accurately show actual conditions as constructed. Users are responsible to verify actual field conditions. These files are not intended to be used as shop drawings.

END OF SECTION 26 01 00

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SECTION 26 05 00
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Common electrical installation requirements.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

1.4 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Through-Penetration Firestop Systems."

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Through-Penetration Firestop Systems."

C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Extend sleeves installed in floors 2 inches above finished floor level.

F. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.

G. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

H. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with Division 07 Section "Through-Penetration Firestop Systems."

I. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

J. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

K. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Through-Penetration Firestop Systems."

END OF SECTION 26 05 00

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SECTION 26 05 19
CONDUCTORS AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all equipment, labor, material, accessories, and mounting hardware to properly install all conductors and cables rated 600 volts and less for a complete and operating system for the following:

1. Conductors and cable.
2. Wiring connectors and connections.

B. All sizes shall be given in American Wire Gauge (AWG) or in thousand circular mils (MCM).

1.2 SUBMITTALS

A. Product Data: Submit catalog cut sheet showing, type and U.L. listing of each type of conductor, connector and termination.

1.3 QUALITY ASSURANCE

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.4 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper unless noted otherwise.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.5 COORDINATION

A. Determine required separation between cable and other work.

B. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 BUILDING WIRE AND CABLE

A. Aluminum and Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and XHHW.

C. Insulation Voltage Rating: 600 volts.

PART 3 - EXECUTION

3.1 GENERAL

A. Install products in accordance with manufacturer's instructions.

B. Conductors #10 AWG or #12 AWG shall be 600 volt type THWN/THHN unless noted otherwise, rated 90 degrees C. dry.

C. Use solid conductor for feeders and branch circuits 10 AWG and smaller (except for control circuits).

D. Use conductor not smaller than 12 AWG for power and lighting circuits.

E. Neatly train and lace wiring inside boxes, equipment, and panelboards.

F. All conductors shall be installed in raceway.

G. Conductor sizes indicated on circuit homeruns or in schedules shall be installed over the entire length of the circuit unless noted otherwise on the drawings or in these specifications.

H. Before installing raceways and pulling wire to any mechanical equipment, verify electrical characteristics with final submittal on equipment to assure proper number and AWG of conductors. (As for multiple speed motors, different motor starter arrangements, etc.).

I. Coordinate all wire sizes with lug sizes on equipment, devices, etc. Provide/install lugs as required to match wire size.

J. Where oversized conductors are called for (due to voltage drop, etc.) provide/install lugs as required to match conductors, or provide/install splice box, and splice to reduce conductor size to match lug size.

3.2 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire has been completed.

3.3 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.4 WIRING METHODS

A. Use only building wire, Type THHN/THWN insulation, in raceway unless noted otherwise.

B. Wiring in vicinity of heat producing equipment: Use only XHHW insulation, in raceway.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Section 26 05 53.

B. Identify each conductor with its circuit number or other designation indicated on Drawings.

C. Identify neutrals with its associated circuit number(s).

3.6 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of the General Requirements of the Contract Documents.

B. Inspect wire for physical damage and proper connection.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

D. Verify continuity of each branch circuit conductor.

3.7 PULLING

A. No wire shall be pulled until the conduit system is complete from pull point to pull point and major equipment terminating conduits have been fixed in position.

B. Mechanical pulling devices shall not be used on conductors sized #8 and smaller. Pulling means which might damage the raceway shall not be used.

C. Use only powdered soapstone or other pulling lubricant acceptable to the A/E. Compound or lubricant shall not cause the conductor or insulation to deteriorate.

D. All conductors to be installed in a common raceway shall be pulled together. The manufacturer's recommended pulling tensions shall not be exceeded.

E. Bending radius of insulated wire or cable shall not be less than the minimum recommended by the manufacturer.

F. Where communications type conductors are installed, special requirements shall apply as outlined under that specific system detail specifications.

3.8 CONTROL AND SIGNAL CIRCUITS

A. For control and signal circuits above 50 VAC, conductors shall be #14 AWG minimum size, Type XHHW or THWN-THHN as permitted by NFPA 70, within voltage drop limits, increased to #12 AWG as necessary for proper operation.

B. For control and signal circuits 50 VAC and below, conductors, at the Contractor's option, may be #16 AWG, 300 volt rated, PVC insulated, except where specifically noted otherwise in the contract documents.

C. Conductor insulation for Fire Alarm Systems shall be as accepted by Code Inspection Authority only. Wire acceptance by the A/E shall not supersede this final Acceptance for conditions of this specific project.

D. Install circuit conductors in conduit.

E. Circuit conductors to be stranded.

3.9 COLOR CODING

A. All power feeders and branch circuits No. 6 and smaller shall be wired with color-coded wire with the same color used for a system throughout the building. Power feeders above No. 6 shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape or paint in all junction boxes and panels. Tape or paint shall completely cover the full length of conductor insulation within the box or panel.

B. Unless otherwise accepted or required by A/E to match existing, color-code shall be as follows: Neutrals to be white for 120/208V system, natural grey for 277/480V system; ground wire green, bare. 120/208V, Phase A - black; Phase B - red; Phase C - blue. 480/277V, Phase A brown; Phase B - orange; Phase C - yellow. All switch legs, other voltage system wiring, control and interlock wiring shall be color-coded other than those above.

3.10 TAPS/SPLICES/CONNECTORS/TERMINATIONS

A. Clean conductor surfaces before installing lugs and connectors.

B. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

C. Power and lighting conductors shall be continuous and unspliced where located within conduit. Splices shall occur within troughs, wireways, outlet boxes, or equipment enclosures where sufficient additional room is provided for all splices. No splices shall be made in in-ground pull boxes (without written acceptance of engineer).

D. Splices in lighting and power outlet boxes, wireway, and troughs shall be kept to a minimum, pull conductors through to equipment, terminal cabinets, and devices.

E. No splices shall be made in junction box, and outlet boxes (wire No. 8 and larger) without written acceptance of Engineer.

F. No splices shall be made in communications outlet boxes, pull boxes or wireways (i.e., fire alarm, computer, telephone, intercom, sound system, etc.) without written acceptance of Engineer. Pull cables through to equipment cabinets, terminal cabinets and devices.

G. Allow adequate conductor lengths in all junction boxes, pull boxes and terminal cabinets. All termination of conductors in which conductor is in tension will be rejected and shall be replaced with conductors of adequate length. This requirement shall include the providing by the Contractor of sleeve type vertical cable supports in vertical raceway installations provided in pullboxes at proper vertical spacings.

H. A calibrated torque wrench shall be used for all bolt tightening.

I. Interior Locations:

1. All (non-electronic systems) copper taps and splices in No. 8 or smaller shall be fastened together by means of "spring type" connectors. All taps and splices in wire larger than No. 8 shall be made with compression type connectors and taped to provide insulation equal to wire.

J. Exterior Locations:

1. Make splices, taps and terminations above grade in splice or termination cabinets. Do not splice any cable in ground or below finished grade.
2. All taps and splices shall be made with compression type connectors and covered with Raychem heavywall cable sleeves (type CRSM-CT, WCSM or MCK) with type "S" sealant coating with sleeve kits as per manufacturer's installation instructions or be terminated/connected to terminal strips in above grade terminal boxes suitable for use.
3. Provide and install above grade termination cabinets sized to meet applicable codes and standards, where required for splicing.

END OF SECTION 26 05 19

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SECTION 26 05 26
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:

1. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.
5. Grounding for sensitive electronic equipment.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, and grounding connections for separately derived systems based on NFPA 70B.

    a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Stranded Conductors: ASTM B 8.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by10 feet in diameter. Increase lengths as required to meet and achieve specified resistance.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bar: Install in electrical and communication equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Flexible raceway runs.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System where available: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 02 Section "Underground Ducts and Utility Structures," and shall be at least 12 inches deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

H. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power Distribution Units or Panelboards Serving Electronic Equipment: 5 ohm(s).
3. Substations and Pad-Mounted Equipment: 5 ohms.
4. Manhole Grounds: 10 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

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SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 SUBMITTALS

A. Product Data: For steel slotted support systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Steel slotted channel systems. Include Product Data for components.
2. Equipment supports.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. Thomas & Betts Corporation.
d. Unistrut; Tyco International, Ltd.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers:

1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Manufacturers:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with clamps approved for application by an agency acceptable to authorities having jurisdiction.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

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SECTION 26 05 33
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. IMC: ANSI C80.6.

C. EMT: ANSI C80.3.

D. FMC: Zinc-coated steel.

E. LFMC: Flexible steel conduit with PVC jacket.

F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Set-screw or compression type, steel or die-cast.

2.2 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Schedule 40 and 80 PVC.

B. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS

A. Manufacturers:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.
4. Or equal approved by Engineer.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type.

E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers.

1. Manufacturers:

a. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

C. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

G. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit or IMC.
2. Concealed Conduit, Aboveground: Rigid steel conduit or IMC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Concealed in Ceilings and Interior Walls and Partitions: EMT.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
4. Damp or Wet Locations: Rigid steel conduit.
5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

K. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

L. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

M. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

N. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earthwork" for pipe less than 6 inches in nominal diameter.

2. Install backfill as specified in Division 31 Section "Earthwork."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earthwork."
4. Install manufactured rigid steel or PVC conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
5. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align planks along the width and along the centerline of conduit.

3.4 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Through-Penetration Firestop Systems."

END OF SECTION 26 05 33

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SECTION 26 05 53
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide and install all equipment, labor and material for a complete identification system, including but not limited to:

1. Nameplates and labels.
2. Wire and cable markers.
3. Conduit markers.

1.2 QUALITY ASSURANCE

A. ANSI/NFPA 70 - National Electrical Code.

B. Americans with Disabilities Act – 1990.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Nameplates shall be laminated phenolic plastic, chamfer edges.

1. For 120/208 Volt System:

a) Black front and back with white core, with lettering etched through the outer covering. White engraved letters on black background.

2. For 277/480 Volt System:

a) Brown with white letters.

3. For Emergency System:

a) Orange with white letters.

B. Nameplates for emergency power shall be laminated phenolic plastic. Orange front and back, with white core, with lettering etched through outer covering, white engraved letters on red background.

C. Letter Size:

1. 1/8 inch letters for identifying individual equipment and loads.
2. 1/4 inch letters for identifying grouped equipment and loads.

D. Nameplates shall adequately describe the function of the particular equipment involved. Where nameplates are detailed on the drawings, inscription and size of letters shall be as shown and shop drawing submitted for acceptance. Nameplates for panelboards, switchboards, motor control centers, disconnects and enclosed breakers shall include the panel designation, voltage and phase of the supply. For example, "Panel A, 120/208V, 3-phase, 4-wire". In addition, provide phenolic label in panel to describe where the panel is fed from and location. For example, "Fed from MDP-1:3:5 Electrical Room #E101 Level 1". Nameplates for equipment listed below shall describe particular equipment name and associated panel/ckt (if applicable). The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and P.B. station nameplates for that machine.

E. The following items shall be equipped with nameplates:

1. All transformers, switchboards, panelboards, circuit breakers (i.e., all 2 pole, 3 pole CB's.), and junction and pull boxes (larger than 4-11/16"). Nameplates shall also describe the associated panel and circuit number (if applicable).

F. All Electrical System panels, transfer switches, motor control centers, disconnect switches, motor controllers, etc. shall be labeled as per branch, i.e.: "Panel ABC Emergency-Life Safety Branch" (similar for emergency legally required standby branch or emergency optional standby branch).

2.2 WIRE MARKERS

A. Description: Cloth, tape, split sleeve, or tubing type wire markers.

B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.

C. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings including neutral conductor.
2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on shop drawings.

2.3 CONDUIT/JUNCTION BOX MARKER

A. All new and existing junction boxes/cover plates for power, lighting and systems (except those installed in public areas) shall adequately describe its associated panel and circuit reference number(s) within, (i.e. ELRW-2, 4, 6) or systems within (i.e. fire alarm, intercom, etc.). Identification shall be neatly written by means of black permanent marker. (Paint 1/2 cover plate with appropriate color above, and 1/2 with associated panel/circuit or system as described above.) Junction box cover plates located in public areas shall be identified with small phenolic labels securely attached. Label colors to be determined by A/E. Large pull/junction boxes (8" x 8" or larger) shall be color identified by painting the corners of box cover plate with specified colors at 45^{o} angles and phenolic labels as specified herein.

B. Identify conduit not installed in public areas with corresponding panel/circuit numbers or corresponding system type as described above. Spacing: 20 ft. on center adjacent to color identification bands.

2.4 UNDERGROUND WARNING TAPE

A. Description: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

A. Install nameplate parallel to equipment lines.

B. Secure nameplate to equipment front using stainless steel pop rivets.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

D. Nameplates installed inside on dead front cover shall be self adhesive tape. (Do not drill or install screws in dead front.)

E. Identify new conduit, junction boxes, and outlet boxes using field painting.

F. Identify new underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

G. Install wire markers at all new connections and terminations and existing connections and terminations, modified or altered.

END OF SECTION 26 05 53

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SECTION 26 05 73
OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.

1. Coordination of series-rated devices is not permitted.
2. Result shall be an electrical system with fully rated selectively coordinated overcurrent devices.
3. Scope of study shall include all new electrical equipment and installations and all existing installations that are affected by the new.

1.2 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

C. Qualification Data: For coordination-study and fault-current study specialist.

D. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed.

1. Coordination-study and fault-current study input data, including completed computer program input data sheets.
2. Study and Equipment Evaluation Reports.
3. Coordination-Study and Fault-Current Study Report.
4. Arc Flash Report.

1.3 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Basis-of-Design Product: Provide computer analysis with SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Additional Features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams,

overcurrent protective device submittals, input and output data, and recommended device settings.

2. Impedance of service entrance.
3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:

    a. Circuit-breaker and fuse-current ratings and types.
    b. Relays and associated power and current transformer ratings and ratios.
    c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
    d. Generator kilovolt amperes, size, voltage, and source impedance.
    e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
    f. Motor horsepower and code letter designation according to NEMA MG 1.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    f. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    g. Panelboards and switchboards, interrupting rating in amperes rms symmetrical.

3.3 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:

    1. Main switchboard distribution busses.
    2. Distribution panelboard.
    3. Branch circuit panelboard.
    4. Engine generator transfer switches.

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 141, IEEE 241 and IEEE 242.

1. Transformers:

    a. ANSI C57.12.10.
    b. ANSI C57.12.22.
    c. ANSI C57.12.40.
    d. IEEE C57.12.00.
    e. IEEE C57.96.

2. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
3. Low-Voltage Fuses: IEEE C37.46.

E. Study Report:

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.

F. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.4 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
3. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 242 recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

    a. Inrush current when first energized.
    b. Self-cooled, full-load current.
    c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping

time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

E. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:

   a. Device tag.
   b. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
   c. Fuse-current rating and type.
   d. Ground-fault relay-pickup and time-delay settings.

2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

   a. Device tag.
   b. Voltage and current ratio for curves.
   c. Three-phase and single-phase damage points for each transformer.
   d. No damage, melting, and clearing curves for fuses.
   e. Cable damage curves.
   f. Transformer inrush points.
   g. Maximum fault-current cutoff point.

F. Completed data sheets for setting of overcurrent protective devices.

3.5 ARC FLASH HAZARD STUDY

A. Provide an Arch Flash Hazard Study for the electrical distribution system shown on the one line drawings updated to use equipment actually installed, if different. The intent of the Arc Flash Hazard Study is to determine hazards that exist at each major piece of electrical equipment shown on the one line drawing. This includes switchboards, panelboards, motor control centers, UPS, ATS's, and transformers. The study will include creation of Arc Flash Hazard Warning Labels to serve as a guide to assist technicians and others in the selection of proper Personal Protective Equipment when working around exposed and energized conductors. The electrical contractor will install the labels.

B. The Arc Flash Hazard Study shall consider operation during normal conditions alternate operations, emergency power conditions, and any other operations, which could result in maximum arc flash hazard.

C. Perform the Arc Flash Hazard Study after the short circuit and protective device coordination study has been completed based upon IEEE Std 1584, "IEEE Guide For Performing Arc Flash Hazard Calculations". The study shall be in accordance with applicable NFPA 70E, OSHA 29-CFR, Part 1910 Sub part S and IEEE 1584 Standards. Determine the following:

1. Flash Hazard Protection Boundary.
2. Limited Approach Boundary.

3. Restricted Boundary.
4. Prohibited Boundary.
5. Incident Energy Level.
6. Required Personal Protective Equipment Class.
7. Type of Fire Rated Clothing.

D. Produce an Arc Flash Warning label listing items 1-7 above. Also include the bus name, system operating voltage, and date of issue. Labels shall be printed in color and be printed on adhesive backed Avery Labels.

E. Produce Bus Detail sheets that list the items C 1-7 from above and the following additional items:

1. Bus Name.
2. Upstream Protective Device Name, Type, and Settings.
3. Bus Line to Line Voltage.

F. Produce Arc Flash Evaluation Summary Sheet listing the following additional items:

1. Bus Name.
2. Upstream Protective Device Name, Type, and Settings.
3. Bus Line to Line Voltage.
4. Bus Bolted Fault.
5. Protective Device Bolted Fault Current.
6. Arcing Fault Current.
7. Protective Device Trip/Delay Time.
8. Breaker Opening Time.
9. Solidly Grounded Column.
10. Equipment Type.
11. Gap.
12. Arc Flash Boundary.
13. Working Distance.
14. Incident Energy.
15. Required Protective Fire Rated Clothing Type and Class.

G. Analyze the short circuit, protective device coordination, and arc flash calculations and highlight any equipment that is determined to be underrated or causes an abnormally high incident energy calculation. Propose approaches to reduce the energy levels.

3.6 REPORTS

A. The results of the power system study shall be summarized in a final written report. The report shall include the following sections:

1. Executive Summary – A synopsis of our overall findings, including but not limited to equipment locations with highest incident energy levels, total number of overcurrent protective devices with inadequate short circuit current interrupting ratings, and identification of equipment protective boundary conflicts.
2. Introduction – A brief paragraph to explain the necessity of performing an arc flash hazard analysis and the criteria used during the project.
3. Methodology – A brief paragraph to explain the basis for the analyses performed for this project.
4. Assumptions – A list of all valid engineering assumptions made and why they were made during the course of the project.

5. Discussion – A detailed discussion of each of the following power system analysis performed for this project:

    a. Short Circuit Analysis Results.
    b. Protective Device Coordination Study Results.
    c. Arc-Flash Hazard Analysis Results.

6. Recommendations – Our detailed recommendations to reduce existing incident energy levels and to improve overall future maintenance & operation of the plant.
7. Bibliography – Industry references used to complete the arc-flash analysis for this plant.

B. Provide three (3) copies of each report together with one electronic copy of the SKM files for the Engineer.

END OF SECTION 26 05 73

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SECTION 26 05 73.13
SHORT-CIRCUIT STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For computer software program to be used for studies.
2. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

    a. Short-circuit study input data, including completed computer program input data sheets.
    b. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

        1) Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
        2) Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power Systems Analysis Software Developer.
2. For Power System Analysis Specialist.
3. For Field Adjusting Agency.

B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

1. Power System Analysis Software Qualifications: Computer program shall be designed to perform short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

D. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

E. Short-Circuit Study Certification: Short-Circuit Study Report shall be signed and sealed by Power Systems Analysis Specialist.

F. Field Adjusting Agency Qualifications:

1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
2. A member company of NETA.
3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CGI CYME.
2. EDSA Micro Corporation.
3. ESA Inc.
4. Operation Technology, Inc.
5. Power Analytics, Corporation.
6. SKM Systems Analysis, Inc.

B. Comply with IEEE 399 and IEEE 551.

1. Analytical features of power systems analysis software program shall have capability to calculate "mandatory" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
6. Derating factors and environmental conditions.
7. Any revisions to electrical equipment required by the study.

D. Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data:

1. One-line diagram of system being studied.
2. Power sources available.
3. Manufacturer, model, and interrupting rating of protective devices.
4. Conductors.
5. Transformer data.

G. Short-Circuit Study Output Reports:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.

b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. Calculated asymmetrical fault currents:

1) Based on fault-point X/R ratio.
2) Based on calculated symmetrical value multiplied by 1.6.
3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the study.

B. Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Section 01 78 39 "Project Record Documents" for recording circuit protective device characteristics. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on device characteristics supplied by device manufacturer.

D. Extent of electrical power system to be studied is indicated on Drawings.

E. Begin short-circuit current analysis at the service, extending down to system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240 V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

I. Include in the report identification of any protective device applied outside its capacity.

END OF SECTION 26 05 73.13

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SECTION 26 05 73.16
COORDINATION STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For computer software program to be used for studies.
2. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

    a. Coordination-study input data, including completed computer program input data sheets.
    b. Study and equipment evaluation reports.

3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power System Analysis Software Developer.
2. For Power Systems Analysis Specialist.
3. For Field Adjusting Agency.

B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Studies shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

D. Power System Analysis Software Qualifications:

1. Computer program shall be designed to perform coordination studies or have a function, component, or add-on module designed to perform coordination studies.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

E. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

F. Field Adjusting Agency Qualifications:

1. Employer of a NETA ETT-Certified Technician Level III responsible for all field adjusting of the Work.
2. A member company of NETA.
3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CGI CYME.
2. EDSA Micro Corporation.
3. ESA Inc.
4. Operation Technology, Inc.
5. Power Analytics, Corporation.
6. SKM Systems Analysis, Inc.

B. Comply with IEEE 242 and IEEE 399.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

2.2 COORDINATION STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.
6. Any revisions to electrical equipment required by the study.
7. Study Input Data: As described in "Power System Data" Article.

a. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 05 73.13 "Short-Circuit Studies."

D. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

a. Phase and Ground Relays:

1) Device tag.
2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
3) Recommendations on improved relaying systems, if applicable.

b. Circuit Breakers:

1) Adjustable pickups and time delays (long time, short time, and ground).
2) Adjustable time-current characteristic.
3) Adjustable instantaneous pickup.
4) Recommendations on improved trip systems, if applicable.

c. Fuses: Show current rating, voltage, and class.

E. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:

    a. Power utility's overcurrent protective device.
    b. Low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
    c. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
    d. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
    e. Ground-fault protective devices.
    f. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Maintain selectivity for tripping currents caused by overloads.
6. Provide adequate time margins between device characteristics such that selective operation is achieved.
7. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in one-line diagram on Drawings. Call any discrepancies to Architect's attention.
2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.

B. Gather and tabulate all required input data to support the coordination study. List below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.

3.3 COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. Base study on device characteristics supplied by device manufacturer.

D. Extent of electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240 V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

H. Motor Protection:

1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

J. Generator Protection: Select protection according to manufacturer's written instructions and to IEEE 242.

K. Include the ac fault-current decay from induction motors and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.

L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

M. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Include in the report identification of any protective device applied outside its capacity.

3.4 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:

1. Determine load flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
2. Determine load flow and voltage drop based on 80 percent of the design capacity of load buses.
3. Prepare load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.5 MOTOR-STARTING STUDY

A. Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141, and voltage sags so as not to affect operation of other utilization equipment on system supplying the motor.

3.6 FIELD ADJUSTING

A. Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of equipment manufacturer under the "Startup and Acceptance Testing" contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.7 DEMONSTRATION

A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in the following:

1. Acquaint personnel in fundamentals of operating the power system in normal and emergency modes.
2. Hand-out and explain the coordination study objectives, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting time-current coordination curves.
3. For Owner's maintenance staff certified as NETA ETT-Certified Technicians Level III or NICET Electrical Power Testing Level III Technicians, teach how to adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 26 05 73.16

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SECTION 26 05 73.19
ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals may be in digital form:

1. Arc-flash study input data, including completed computer program input data sheets.
2. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.
3. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power Systems Analysis Software Developer.
2. For Power System Analysis Specialist.
3. For Field Adjusting Agency.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

D. Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Computer program shall be designed to perform arc-flash analysis or have a function, component, or add-on module designed to perform arc-flash analysis.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

E. Power Systems Analysis Specialist Qualifications: Professional engineer in charge of performing the arc-flash study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.

G. Field Adjusting Agency Qualifications:

1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
2. A member company of NETA.
3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CGI CYME.
2. EDSA Micro Corporation.
3. ESA Inc.
4. Operation Technology, Inc.
5. Power Analytics, Corporation.
6. SKM Systems Analysis, Inc.

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings, including derating factors and environmental conditions.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 05 73.13 "Short-Circuit Studies."

F. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 26 05 73.16 "Coordination Studies."

G. Arc-Flash Study Output Reports:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

H. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Restricted approach boundary.
6. Limited approach boundary.
7. Working distance.
8. Incident energy.
9. Hazard risk category.
10. Recommendations for arc-flash energy reduction.

I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

2.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis.

B. Label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Protection boundaries.

    a. Arc-flash boundary.
    b. Restricted approach boundary.
    c. Limited approach boundary.

4. Arc flash PPE category.
5. Required minimum arc rating of PPE in Cal/cm squared.
6. Available incident energy.
7. Working distance.
8. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination study prior to starting the Arc-Flash Hazard Analysis.

1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 05 73.13 "Short-Circuit Studies."
2. Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 26 05 73.16 "Coordination Studies."

C. Calculate maximum and minimum contributions of fault-current size.

1. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
3. Calculate arc-flash energy at 38 percent of maximum short-circuit current according to NFPA 70E recommendations.
4. Calculate arc-flash energy with the utility contribution at a minimum and assume no motor contribution.

D. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.

E. Include low-voltage equipment locations, except equipment rated 240 V ac or less fed from transformers less than 125 kVA.

F. Calculate the limited, restricted, and prohibited approach boundaries for each location.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors shall not be considered beyond three to five cycles.

H. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to Architect's attention.
2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.

3.4 LABELING

A. Apply one arc-flash label on the front cover of each section of the equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.

B. Each piece of equipment listed below shall have an arc-flash label applied to it:

1. Low-voltage switchboard.

2. Switchgear.
3. Low voltage transformers.
4. Panelboard and safety switch over 250 V.
5. Applicable panelboard and safety switch under 250 V.
6. Control panel.

C. Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.

1. Indicate arc-flash energy.
2. Indicate protection level required.

3.5 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.6 DEMONSTRATION

A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels.

END OF SECTION 26 05 73.19

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following lighting control devices:

1. Time switches.
2. Outdoor photoelectric switches.
3. Indoor occupancy sensors.
4. Lighting contactors.
5. Emergency shunt relay.

B. See Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Available Manufacturers: Subject to compliance with requirements.

1. Watt Stopper (The).

B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Contact Configuration: As indicated on drawings.
2. Contact Rating: 30-A inductive or resistive, 240-V ac.
3. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.

4. Program: 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
5. Programs: 8 channels; each channel shall be individually programmable with 8 on-off set points on a 24-hour schedule.
6. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
7. Astronomic Time: All channels.
8. Battery Backup: For schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Available Manufacturers: Subject to compliance with requirements.

1. Watt Stopper (The).

B. Description: Solid state, with DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

C. Description: Solid state, with DPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.

1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
2. Time Delay: 30-second minimum, to prevent false operation.
3. Lightning Arrester: Air-gap type.
4. Mounting: Twist lock complying with IEEE C136.10, with base.

2.3 INDOOR OCCUPANCY SENSORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or:

1. Watt Stopper (The).

D. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.

E. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.

2.4 OUTDOOR MOTION SENSORS (PIR)

A. Available Manufacturers: Subject to compliance with requirements.

1. Watt Stopper (The).

B. Performance Requirements: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as raintight according to UL 773A.

1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
    b. Relay: Internally mounted in a standard weatherproof electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

3. Bypass Switch: Override the on function in case of sensor failure.
4. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc; keep lighting off during daylight hours.

C. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..

D. Detection Coverage: Up to 35 feet, with a field of view of 180 degrees.

E. Lighting Fixture Mounted Sensor: Suitable for switching 300 W of tungsten load at 120- or 277-V ac.

F. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.

1. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

2.5 LIGHTING CONTACTORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Square D; Schneider Electric.
2. Watt Stopper (The).

B. Description: Electrically operated and mechanically held, combination type with nonfused disconnect, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as scheduled, matching the NEMA type specified for the enclosure.

2.6 EMERGENCY SHUNT RELAY

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Lighting Control and Design, Inc.

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.

1. Coil Rating: 277 V.

2.7 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 3/4 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION 26 09 23

SECTION 26 22 13
LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.

C. Source quality-control reports.

D. Field quality-control reports.

E. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.

1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.

B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.

C. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Square D; Schneider Electric.

B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Comply with NFPA 70.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Transformers Rated 15 kVA and Larger:

1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.

D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70.

B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

1. One leg per phase.
2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
3. Grounded to enclosure.

C. Coils: Continuous windings except for taps.

1. Coil Material: Aluminum.
2. Internal Coil Connections: Brazed or pressure type.
3. Terminal Connections: Bolted.

D. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.

E. Enclosure: Ventilated.

1. NEMA 250, Type 2 for indoors and Type 3R for outdoors: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.
4. Finish: Comply with NEMA 250.

a. Finish Color: ANSI 49 gray weather-resistant enamel.

F. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

G. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

H. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.

I. Wall Brackets: Manufacturer's standard brackets

2.4 IDENTIFICATION

A. Nameplates: Refer to specification 26 05 53 Electrical Identification for requirements

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.

B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

C. Construct concrete bases and anchor floor-mounted transformers according to manufacturer's written instructions.

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

D. Secure transformer to concrete base according to manufacturer's written instructions.

E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Remove and replace units that do not pass tests or inspections and retest as specified above.

C. Verify transformer vibration isolation pads are properly installed and mounting bolts are loose enough to prevent transmission of vibration.

D. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 22 13

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SECTION 26 24 13
SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Disconnecting and overcurrent protective devices.
3. Instrumentation.
4. Control power.
5. Accessory components and features.
6. Identification.

B. Reference:

1. Refer to Contract Drawings for additional details and installation conditions.

1.2 SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail bus configuration, current, and voltage ratings.
3. Detail short-circuit current rating of switchboards and overcurrent protective devices.
4. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals.

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 2.

E. Comply with NFPA 70.

F. Comply with UL 891.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.5 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Service Conditions: NEMA PB 2, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.6 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment,

raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Provide a 4 inch thick concrete bases with 1 inch chamfered edges, for all floor mounted electrical gear. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.7 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year with extended warranties provided by manufacturers.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Basis-of-design Product: Subject to compliance with requirements, provide Square D; a brand of Schneider Electric.

B. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.
4. Rear access and rear clearance not allowed.

C. Nominal System Voltage: 480Y/277 V.

D. Main-Bus Continuous: As indicated on Drawings.

E. Indoor Enclosures: Steel, NEMA 250, Type 1.

F. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

G. Barriers: Between adjacent switchboard sections.

H. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

I. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

J. Pull Box on Top of Switchboard:

1. Provide where required and/or specified.

2. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
3. Set back from front to clear circuit-breaker removal mechanism.
4. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
5. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
6. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

K. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity or tin-plated, high-strength, electrical-grade aluminum alloy.
2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
3. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
4. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
5. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

L. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

M. Surge Protective Device: Furnish and install 3 phase, 4 wire unit meeting UL1449, Edition 3. Reference Section 26 43 13 Surge Protection for Low-Voltage Electrical Power Circuits.

2.2 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Circuit breakers smaller than 400 ampere frame size shall be thermal-magnetic type, with inverse time-current element for over-load and magnetic instant trip for short circuit protection. 250 amp and larger shall have adjustable magnetic trip feature.
2. Circuit breakers having 200 ampere or larger frame size shall be rms sensing, 100% rated, electronic trip type.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
    c. Shunt Trip: Provide where indicated on drawings. 120-V or 277-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.

2.3 INSTRUMENTATION

A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
2. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

    a. Phase Currents, Each Phase: Plus or minus 1 percent.
    b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
    c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
    d. Megawatts: Plus or minus 2 percent.
    e. Megavars: Plus or minus 2 percent.
    f. Power Factor: Plus or minus 2 percent.
    g. Frequency: Plus or minus 0.5 percent.
    h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
    i. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
    j. Contact devices to operate remote impulse-totalizing demand meter.

2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.
3. Memory Backup: Self-contained to maintain memory throughout power outages of 72 hours, minimum.
4. Building Automation System (BAS) Interface: One digital KY pulse to a user-definable increment of energy measurement. Coordinate with mechanical controls contractor to match signal to BAS input and arrange to convey the instantaneous, integrated, demand level measured by meter to provide data for processing and possible programmed demand control action by destination system. Meter shall match BAS system communications protocol.

2.4 CONTROL POWER

A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

C. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.5 IDENTIFICATION

A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

E. Install filler plates in unused spaces of panel-mounted sections.

F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

G. Comply with NECA 1.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Switchboard will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION 26 24 13

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

    a. Enclosure types and details for types other than NEMA 250, Type 1.
    b. Bus configuration, current, and voltage ratings.
    c. Short-circuit current rating of panelboards and overcurrent protective devices.
    d. UL listing for series rating of installed devices.
    e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.
3. Field quality-control test reports.
4. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

D. All equipment specified herein shall have a 35-50 year serviceable life.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

a. Square D; a brand of Schneider Electric.

2.2 MANUFACTURED UNITS

A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.

1. Rated for environmental conditions at installed location.
2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

B. Phase and Ground Buses: Hard-drawn copper, 98 percent conductivity.

C. Conductor Connectors: Suitable for use with conductor material.

1. Ground Lugs and Bus Configured Terminators: Compression type.

D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Rating:

1. UL label indicating series-connected rating with integral or remote upstream overcurrent protective devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.

2.3 DISTRIBUTION PANELBOARDS

A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

B. Main Overcurrent Protective Devices: Circuit breaker.

C. Branch Overcurrent Protective Devices:

1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with series-connected rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable Electronic trip setting for circuit-breaker frame sizes 250 A and larger.
2. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
3. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

a. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
b. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
c. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Furnish portable test set to test functions of solid-state trip devices without removal from panelboard.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 74 inches above finished floor, unless otherwise indicated.

C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Install overcurrent protective devices and controllers.

E. Install filler plates in unused spaces.

F. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."

G. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic nameplate mounted per section 26 05 53 Electrical Identification

H. Provide typed panel schedule for new panels or when circuits are added to existing panels.

I. Ground equipment according to Division 26 Section "Grounding and Bonding."

J. Connect wiring according to Division 26 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION 26 24 16

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Snap switches.
3. Wall-switch sensors.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; GF20.
b. Pass & Seymour; 2084.

2.4 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221PL for 120 V and 277 V.
b. Hubbell; HPL1221PL for 120 V and 277 V.
c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
d. Pass & Seymour; PS20AC1-PLR for 120 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 2221L.
   b. Hubbell; HBL1221L.
   c. Leviton; 1221-2L.
   d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.5 OCCUPANCY SENSORS

A. Long-Range Wall-Switch Sensors:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Hubbell; ATD1600WRP.
   b. Leviton; ODW12-MRW.
   c. Watt Stopper (The); DT-200.

2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft..

2.6 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- thick, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.7 FLOOR SERVICE FITTINGS

A. Type: Modular, flap-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, solid brass with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

2.8 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

END OF SECTION 26 27 26

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SECTION 26 28 13
FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cartridge fuses rated 600-V ac and less for use in enclosed switches, panelboards, switchboards, and motor-control centers.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA FU 1 for cartridge fuses.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

A. Feeders: Class RK5, time delay.

B. Motor Branch Circuits: Class RK5, time delay.

C. Other Branch Circuits: Class RK5, time delay.

3.2 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION 26 28 13

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers.
4. Molded-case switches.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. HD: Heavy duty.

C. RMS: Root mean square.

D. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current rating.
4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Qualification Data: For testing agency.

D. Field quality-control test reports including the following:

1. Test procedures used.

2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Closeout Procedures," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spares: For the following:

a. Potential Transformer Fuses: 10% of each size but not less than three.
b. Control-Power Fuses: 10% of each size but not less than three.
c. Fuses and Fusible Devices for Fused Circuit Breakers: 10% of each size but not less than three.
d. Fuses for Fusible Switches: 10% of each size but not less than three.
e. Fuses for Fused Power Circuit Devices: 10% of each size but not less than three.

2. Spare Indicating Lights: Six of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Square D/Group Schneider as base bid.
2. Cutler Hammer as alternate.

B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Nonfusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.

2.3 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:

1. General Electric Co.; Electrical Distribution & Control Division.
2. Siemens Energy & Automation, Inc.
3. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
   3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

      a. Instantaneous trip.
      b. Long- and short-time pickup levels.
      c. Long- and short-time time adjustments.
      d. Ground-fault pickup level, time delay, and I^2t response.

   4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
   5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
   6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

C. Molded-Case Circuit-Breaker Features and Accessories:

   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
   3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
   4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
   6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
   7. Auxiliary Switch: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

D. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

E. Molded-Case Switch Accessories:

   1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
   2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
   3. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage. Provide "dummy" trip unit where required for proper operation.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Electrical Identification."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

1. Inspect mechanical and electrical connections.
2. Verify switch and relay type and labeling verification.
3. Verify rating of installed fuses.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Infrared Scanning:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors or panels so connections are accessible to portable scanner.
    b. Follow-Up Infrared Scanning: Perform an additional follow-up infrared scan of each unit 11 months after date of Substantial Completion.
    c. Instruments, Equipment and Reports:

        1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
        2) Prepare a certified report that identifies enclosed switches and circuit breakers included and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 26 28 16

SECTION 26 32 13
ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes packaged engine-generator sets for standby power supply with the following features:

1. Engine.
2. Unit-mounted cooling system.
3. Unit-mounted control and monitoring.
4. Outdoor enclosure.

B. Related Sections include the following:

1. Division 26 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.
2. Time-current characteristic curves for generator protective device.
3. Documentation of EPA Tier compliance for engine.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.

2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
4. Wiring Diagrams: Power, signal, and control wiring.

C. Qualification Data: For installer, manufacturer and testing agency.

D. Source quality-control test reports.

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.
6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.

1. List of tools and replacement items recommended being stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
2. List of user-accessible replacement parts with contact information for local availability.

G. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is factory certified and trained for installation of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
2. Access to Service & Parts: Manufacturer selected by the installer shall maintain a factory-owned or factory authorized parts and service distribution center within 50 miles of the Project Site. A ‘sales office’ will not qualify as a service & parts facility.
3. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: The manufacturer shall be in the business of manufacturing power generation systems under an ISO-9001 certification process for over 10 years. The manufacturer shall employ service, engineering and parts staff within a factory-owned or authorized service center, within 50 miles of Project site.

C. Manufacturer Service Qualifications: The manufacturer shall have a service center within a 50 mile distance from the project site. This service center shall have been in the business of providing engineering, application support, on-site rental, start-up & commissioning, replacement parts and labor for the maintenance and repair of power generation system equipment; for a minimum of 10 years.

D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer so as to provide only one source of warranty and responsibility.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Comply with ASME B15.1.

G. Comply with NFPA 37.

H. Comply with NFPA 70.

I. Comply with NFPA 99.

J. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

K. The generator shall be UL 2200 listed and bear the UL label.

L. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

M. Noise Emission: Comply with applicable state and local government requirements due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Engineer and Owner no fewer than two days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Engineer's or Owner's written permission.

B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 1000 feet.

C. Unusual Service Conditions: Engine-generator equipment and installation are required to operate under the following conditions:

1. High salt-dust content in the air due to sea-spray evaporation.

1.7 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Provide for vibration isolation as per manufacturer's recommendations.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators in addition to associated auxiliary components that fail in materials or workmanship within specified warranty period. The warranty shall include parts, labor, prompt field service, pick-up and delivery.

1. Warranty Period: Five (5) years from date of Substantial Completion.
2. Generator tank and housing shall be warranted to be free of rust for the warranty period.

1.9 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by direct employees of manufacturer's factory service organization. Include quarterly exercising under building load to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide all parts and supplies at no additional charge to the owner, with the exception of fluids in the commissioning of this maintenance. Parts shall be OEM, the same as those used in the manufacture and installation of original equipment.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:

1. Onan/Cummins Power Generation; Industrial Business Group.
2. Kohler Power Systems
3. Generac
4. Caterpillar

2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

C. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
2. Output Connections: Three-phase, three wire.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.
9. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.

a. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.

10. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.

a. Provide permanent magnet excitation for power source to voltage regulator.

2.3 ENGINE

A. Diesel Fuel.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm.

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Engine Fuel System:

1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

G. Governor: Adjustable isochronous, with speed sensing.

H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and non-collapsible under vacuum.
b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

I. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 25 dB at 500 Hz.
2. Sound level measured at a distance of 25 feet from exhaust discharge after installation is complete shall be 85 dBA or less.

J. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

K. Starting System: 12-V electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.4 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system

or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

C. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

D. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a remote wall-mounted control and monitoring panel.

E. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, plus the following:

1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
8. Ammeter-voltmeter, phase-selector switch(es).
9. Generator-voltage adjusting rheostat.
10. Start-stop switch.
11. Overspeed shutdown device.
12. Coolant high-temperature shutdown device.
13. Coolant low-level shutdown device.
14. Oil low-pressure shutdown device.
15. Generator overload.

F. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

G. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals.

H. Common Remote Audible Alarm: Signal the occurrence of any events listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.

1. Engine high-temperature shutdown.
2. Lube-oil, low-pressure shutdown.
3. Overspeed shutdown.
4. Remote emergency-stop shutdown.
5. Engine high-temperature prealarm.
6. Lube-oil, low-pressure prealarm.
7. Low coolant level.

I. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are flush-mounting type to suit mounting conditions indicated.

J. Remote Emergency-Stop Switch: Wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation. Refer to construction documents for location of remote emergency-stop switch.

2.5 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, thermal-magnetic or solid state trip plug with LI sensor, rated at 100% under UL; complying with NEMA AB 1 and UL 489.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator rating.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.
5. Auxiliary Contacts: Provide one set of auxiliary contacts.

B. Ground-Fault Indication: Where service capacity is applicable under NEC, comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications in remote and generator based monitor panels.

2.6 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over speed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Enclosure: Drip proof.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Sub-transient Reactance: 12 percent, maximum.

2.7 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Vandal-resistant, weatherproof, Level 1 sound attenuated aluminum housing (10 dBa reduction at 23 feet), wind resistant up to 150 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

B. Description: Prefabricated or pre-engineered enclosure with the following features:

1. Construction: Non walk-in aluminum, metal-clad integral structural-steel-framed building erected on and attached to the generator skid base. Fade, scratch, and corrosion resistant powder-baked finish. Confirm color with owner.
2. Structural Design and Anchorage: Comply with ASCE 7 for wind loads.
3. Louvers: Equipped with bird screen to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents. Provide with rodent guards and skip end caps to prevent animal entry.
4. Hinged Doors: lockable, flush mounted door latches to prevent tampering.
5. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
6. Sound Enclosure Features – provide with acoustic insulation UL 94 HF1 listed for flame resistance. Cooling air discharge shall be a 90 degree vertical air outlet to reduce noise ambient.
7. Silencer shall be internal to the enclosure and rated per the sound requirements as outlined. Silencer shall be attached to the engine manifold with stainless steel flex and come factory complete with piping, insulation and rain cap. All supports and fasteners in the exhaust shall be stainless steel.

C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.

1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.

2.8 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Provide factory installed vibration isolation pads between the generator skid base and the skid based fuel tank. Isolators shall be Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

B. If the generator does not carry certification of compliance under IBC2000, 2003 or 2006, provide alike vibration isolation between the generator skid base and the concrete pad.

1. Material: Standard neoprene.
2. Durometer Rating: 45.
3. Number of Layers: Two.

2.9 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.10 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor.

C. Provide a factory certified test report to the engineer of record after shipping showing the results of the following tests:

1. Test of components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Full load run extended test. Full load, 2 hour.
3. Maximum power.
4. Voltage regulation.
5. Transient and steady-state governing.
6. Single-step load pickup.
7. Safety shutdown.
8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
9. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator with elastomeric isolator pads if required to meet seismic requirements. Pads shall have a minimum deflection of 1 inch on 4-inch- high concrete base. Secure sets to anchor bolts installed in concrete bases.

D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Piping shall be same diameter as muffler outlet.

1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints.

E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Division 23 Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

C. Connect fuel piping to engines with a gate valve and union and flexible connector.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Identify system components according to Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-employed service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Tests and Inspections:

1. Perform tests recommended by manufacturer. Certify compliance with test parameters.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Confirm equalization of battery cells according to manufacturer's written instructions.

    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.
7. Correct noise levels as directed by engineer.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest as specified above.

I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

K. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, the contractor shall perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: The contractor shall perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 DEMONSTRATION

A. Engage a factory-authorized employed service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 26 32 13

SECTION 26 36 00
TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes automatic transfer switches rated 600 V and less.

B. See Division 21 for automatic transfer switches for fire pumps.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA ICS 1.

C. Comply with NFPA 70.

D. Comply with NFPA 99.

E. Comply with NFPA 110.

F. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Contactor Transfer Switches:

    a. Caterpillar; Engine Div.
    b. Emerson; ASCO Power Technologies, LP.
    c. Generac Power Systems, Inc.
    d. Kohler Power Systems; Generator Division.
    e. Onan/Cummins Power Generation; Industrial Business Group.
    f. Spectrum Detroit Diesel.

2. Transfer Switches Using Molded-Case Switches or Circuit Breakers:

    a. Eaton Electrical Inc.; Cutler-Hammer.
    b. GE Zenith Controls.
    c. Hubbell Industrial Controls, Inc.
    d. Lake Shore Electric Corporation.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.

H. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

I. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.

J. Battery Charger: For generator starting batteries.

1. Float type rated 10 A.
2. Ammeter to display charging current.
3. Fused ac inputs and dc outputs.

K. Enclosures: General-purpose NEMA 250, Type 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

D. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.

E. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase.

F. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated.

G. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer.

H. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.

2.4 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details.

B. Floor-Mounting Switch: Anchor to floor by bolting.

1. Concrete Bases: 4 inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."

C. Identify components according to Division 26 Section "Identification for Electrical Systems."

D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.

5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.

d. Verify pickup and dropout voltages by data readout or inspection of control settings.
e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Remove and replace malfunctioning units and retest as specified above.

F. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Division 01 Section "Demonstration and Training."

B. Coordinate this training with that for generator equipment.

END OF SECTION 26 36 00

SECTION 26 43 13
SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.2 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

B. Field quality-control reports.

C. SPD manufacturer shall provide UL 4th Edition documentations as part of the submittal.

D. Sample Warranty: Manufacturer's warranty statement.

E. Maintenance Data: For SPDs to include in maintenance manuals.

1.4 PROJECT CONDITIONS

A. Service Conditions: Rate SPD devices for continuous operation under the following conditions unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: 30 to 120 deg F.
3. Humidity: 0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet above sea level.

1.5 COORDINATION

A. Coordinate location of field-mounted SPD devices to allow adequate clearances for maintenance.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period. Warranty shall cover unlimited replacement of SPD modules during the warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449 4th edition.

D. Comply with NFPA 780 & UL96A Lighting Protection System Master Label.

E. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCE OR TRANSFER SWITCH SUPPRESSOR

A. Basis-of-Design Product: Subject to compliance with requirements, provide products by one of the following:

1. LEA International.
2. PQ Protection.
3. Advanced Protection Technologies Inc (APT).

B. SPDs: Comply with UL 1449, Type 1.

1. SPDs shall have the following features and accessories:

a. Integral disconnect switch.
b. Modular design (with field replaceable modules redundant per phase and redundant per mode).
c. SPD's shall be mounted external to the panel; internally mounted SPD's are not acceptable.
d. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
e. Indicator light display for protection status.
f. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
g. Surge counter.
h. Audible alarm, with silencing switch to indicate when protection has failed.

C. Comply with UL 1283.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 300 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Protection modes and UL 1449 VPR (clamping voltage) for grounded wye circuits with 480Y/277 V or 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V or 800 V for 208Y/120 V.
2. Line to Ground: 1200 V for 480Y/277 V or 1200 V for 208Y/120 V.
3. Line to Line: 2000 V for 480Y/277 V or 1000 V for 208Y/120 V.

F. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 1000 V.
3. Line to Line: 1000 V.

G. SCCR: Equal or exceed 200 kA.

H. Inominal Rating: 20 kA.

2.3 PANEL SUPPRESSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products by one of the following:

1. LEA International.
2. PQ Protection.
3. Advanced Protection Technologies Inc (APT).

B. SPDs: Comply with UL 1449, Type 2.

1. SPDs shall have the following features and accessories:

a. Compact, non-modular design.
b. SPD's shall be mounted external to the panel; internally mounted SPD's are not acceptable.
c. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
d. Indicator light display for protection status.
e. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
f. Audible alarm, with silencing switch to indicate when protection has failed.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than the following:

1. 100A – 400A branch panelboards: 100kA.
2. 600A – 1200A distribution panelboards: 200kA.
3. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V or 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V or 800 V for 208Y/120 V.
2. Line to Ground: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
3. Neutral to Ground: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
4. Line to Line: 2000 V for 480Y/277 V or 1200 V for 208Y/120 V.

E. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Neutral to Ground: 700 V.
4. Line to Line: 1200 V.

F. SCCR: Equal or exceed 200 kA.

G. Inominal Rating: 20 kA.

2.4 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

B. Outdoor Enclosures: NEMA 250, Type 4.

2.5 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 26 05 19 "Conductors and Cables."

B. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 26 05 19 "Conductors and Cables."

C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 26 05 19 "Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD (sized per manufacturer's recommendation) as required to comply with the UL listing of the SPD.

C. Verify all voltages before connecting to avoid injury and damage to equipment.

D. The SPDs shall be installed external to switchboard, distribution panel, or branch panel.

E. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

F. Refer to manufacturer's installation manual for further details.

G. Use crimped connectors and splices only. Wire nuts are unacceptable.

H. Wiring:

1. Power Wiring: Comply with wiring methods in Section 26 05 19 "Conductors and Cables."
2. Controls: Comply with wiring methods in Section 26 05 19 "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 DEMONSTRATION

A. Train owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 26 43 13

SECTION 26 51 19
LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following types of LED luminaires:

1. Downlight.
2. Strip light.
3. Surface mount, linear.
4. Suspended, linear.
5. Materials.
6. Finishes.
7. Luminaire support.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, arranged by designation.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved:

B. Product Certificates: For each type of luminaire.

C. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.7 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Standards:

1. ENERGY STAR certified.
2. UL Listing: Listed for damp location.
3. Recessed luminaires shall comply with NEMA LE 4.

C. CRI of minimum 80. CCT of 3000 to 4100 K depending on fixture selection.

D. Rated lamp life of 75,000 hours to L70.

E. Lamps dimmable from 100 percent to 0 percent of maximum light output.

F. Internal driver.

G. Nominal Operating Voltage: 120 V ac or 277 V ac.

1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

H. Housings:

1. Painted steel housing and heat sink.
2. Painted finish.

2.2 DOWNLIGHT

A. Minimum 1,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

B. Universal mounting bracket.

C. Integral junction box with conduit fittings.

D. Optics:

1. Fixed lens.
2. Medium light distribution.

2.3 STRIP LIGHT

A. Minimum 1,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

B. Integral junction box with conduit fittings.

2.4 SURFACE MOUNT, LINEAR

A. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

B. Integral junction box with conduit fittings.

2.5 SUSPENDED, LINEAR

A. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

2.6 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Housings:

1. Painted steel housing and heat sink.
2. White painted finish.

2.7 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.8 LUMINAIRE SUPPORT

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Supports: Sized and rated for luminaire weight.

D. Wall-Mounted Luminaire Support:

1. Attached to structural members in stair well or attached to a minimum 20 gauge backing plate attached to structural members.
2. Do not attach luminaires directly to gypsum board.

E. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length.
2. Ceiling mount with pendant mount with 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length.
3. Ceiling mount with hook mount.

F. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.

H. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

I. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 26 51 19

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SECTION 26 55 61
AUDITORIUM STAGE LIGHTING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Special Conditions and Division-1 Specification sections, apply to work specified in this section.

1.2 RELATED WORK AND REQUIREMENTS

A. Section 26 00 00

B. Definitions: For this project the following entities are referenced:

1. Owner: St. Lucie County School Board
2. Architect: Schenkel Shultz Architects
3. Theatre Consultant: TSG Design Solutions, Inc.

1.3 SCOPE

A. This section requires the fabrication, furnishing, delivery, installation and testing of the lighting system as indicated on the drawings and specified herein.

B. The contractor shall provide all materials, equipment, labor, tools, scaffolds, and incidentals necessary to perform the scope of work.

C. It is the intention of these specifications that the contractor provides a professional quality, complete and proper operating system in every respect and detail.

D. The installation contractor shall examine the plans in detail to familiarize him with the scope of the work. Special attention shall be paid to reviewing all project electrical drawings, floor plans, conduit risers, and the like for locations and quantities of boxes and enclosures.

E. The contractor shall assume full responsibility for a complete operating installation, in the required location, in accordance with the contract documents.

F. Coordinate fully with the Division 26 Contractor.

1.4 WORK INCLUDED

A. Without restricting volume or generality of above “Scope,” work to be performed under this section shall include, but not be limited to, the furnishing and installation of the following:

1. Auditorium and Stage

a. A computer controlled dimming system with approximately 116 dimmers and 28 relay circuits. The design shall incorporate 2 front of house lighting battens and three on stage lighting battens with cable management systems, one fixed on-stage electric with a plugging box, four onstage plugging boxes, 2 apron face plugging boxes and one orchestra pit plugging box. A certified stage lighting network with network DMX output nodes and network receptacles that shall be located at each of the previously listed lighting positions. Console plugging stations with network receptacles to connect the stage lighting console and portable house light controller. There shall be two follow spotlights. The stage lighting system consists of the stage dimmer cabinets, an auxiliary lighting rack with network switch and patch bay, circuit distribution raceways, wire, DMX-512 computer-based stage lighting console with 2 screen video display, a mix of conventional, LED, and moving stage lighting fixtures, cables, accessories and spares. The system infrastructure will be network based.

b. A separate house lighting relay rack with approximately 8 circuits with an emergency bypass kit and emergency DMX device for the control of house lighting fixtures shall be included. House Lighting Control shall consist of an architectural control processor and power supply, a portable touch screen control booth control station, a control booth entry station and entry stations located at the auditorium exits and down stage left and right entrances.

B. The Contractor shall examine the plans in detail to familiarize himself with the scope of the work.

C. The Contractor shall provide the required manufacturers' shop drawings.

D. The Contractor shall provide all the necessary specialty equipment for the complete lighting and dimming system installation as specified herein and shown on the drawings.

E. The Contractor shall coordinate the system control wire conduit and device locations with the Division 26 Contractor.

F. The Contractor shall deliver to the job site, and coordinate the installation of, the specialty equipment with the Division 26 Contractor.

G. The Contractor shall provide, install and terminate all system control wires.

H. The Contractor shall provide and install all system control devices.

I. The Contractor shall uncrate, assemble, lamp, hang and aim all the stage lighting fixtures as shown on the drawings.

J. Provide all lighting network certification reports.

K. The Contractor shall provide for the system activation.

L. The Contractor shall provide the system manuals.

M. The Contractor shall provide videotaped training sessions.

N. The Contractor shall provide the system warranty.

O. It is the Contractor's responsibility to ensure that the system and all of the system components, fixtures, equipment, devices, wire, terminations, field assemblies (including custom assemblies), etc. pass all required inspections by the local authority having jurisdiction.

P. Procurement of all required permits.

1.5 WORK NOT INCLUDED

A. The following work, although in another section, has a significant impact on the scope of this work. The Contractor is responsible for the successful coordination of the following:

1. System conduit.
2. Installation and termination of Line supply.
3. Installation and termination of Load wire.
4. Dimmer rack installation.
5. Non-dim panel installation.
6. Distribution installation.

1.6 CONTRACTOR'S QUALIFICATIONS:

A. Only qualified contractors shall be used.

B. The work of this section will be contracted to a single firm, referred to as the contractor.

C. The contractor shall be a lighting system contractor who regularly engages in the furnishing, installation and servicing of systems of similar nature, size, scope and complexity to that contemplated by this specification. The contractor shall have done so for a period of not less than five years preceding the bid date.

D. The contractor shall have maintained for the five years preceding the bid date, a suitably staffed and equipped service organization which has continuously offered maintenance and repair services for systems of the nature, size, scope and complexity to that contemplated by this specification.

E. The contractor shall have on staff a factory trained field service agent, capable of system testing, commissioning and troubleshooting systems of the nature, size, scope and complexity to that contemplated by this specification.

F. The contractor shall have on staff a qualified and competent lighting designer / engineer capable of designing systems of the nature, size, scope and complexity to that contemplated by this specification.

G. The contractor shall maintain for the duration of this contract all required business and professional licenses and insurance.

H. The contractor shall demonstrate to the satisfaction of the owner, through submittals presented in accordance with the project timetable, that the contractor meets all the above qualifications. The minimum contractor qualification submittal shall include the following:

1. Statement of company history. Include a breakdown by percentage of gross sales of all business activities the contractor is involved in for each of the last 5 years (e.g., system installation = 30%, expendable sales = 40%, equipment rentals = 20%, design and other professional services = 10%, etc).
2. Previous experience: Furnish a list of four installations of the type and size contemplated by these specifications, currently in use as originally installed, in which a theatre / system consultant was involved, completed in the last 5 years and the following information regarding each installations:
    a. Name and address of each installation facility.
    b. Facility owner and telephone number.
    c. Name, address, and phone number of a person regularly employed by the owner, who is familiar with the operation of the systems and who has no connection or business connections with the contractor except as the contractor shall fully disclose
    d. Name, address, and phone number of the theatre / system consultant, along with the names of all the consultant's personnel directly involved.
    e. System shop drawing – These will be returned if the contractor provides a call tag or return postage.
    f. Owner's manual drawing – These will be returned if the contractor provides a call tag or return postage.
    g. System as-built drawings drawing – These will be returned if the contractor provides a call tag or return postage.
    h. List of contractors personal involved with each person's responsibility on the project.
    i. Name, address and phone number of the general contractor, along with the names of all key GC personnel directly involved.
    j. Name address and phone number of the electrical contractor, along with the names of all key EC personnel directly involved.

3. Statement of current company capabilities and ownership.
4. Key Personal: For each of the key personnel listed below; Include individual's name, title, and number of continuous years of service to contractor. Include a resume detailing industry experience, and role within organization (include only full-time/regular staff employees; not independent contractor, freelance, or temporary positions). List all industry certifications held, training courses attended, and continuing education credits, including dates of attendance.

    a. Project Manager
    b. Senior Technician
    c. Service Manage

5. Factory Trained Field Service Agent. Include individual's name and title. List all factory held certifications, training courses attended, and continuing education credits, including dates of attendance. Provide a list of recently commissioned systems, scope of project, and commissioning dates.
6. Lighting Designer / Engineer. Include individual's name and title. List current design credits with scope of project, and design completion dates.
7. Other Department Staff. Include size of staff and experience of each staff member.
8. Replacement and Spare Parts Inventory – Provide detailed list of primary replacement parts, components, and spares typically held in inventory.

9. Test Equipment and Physical Plant – Include an inventory of all test facility equipment owned and used regularly by the Service Department. Provide description of physical plant and space utilization.
10. Copies of all business and professional licenses and insurance certificates.

I. For the purposes of this contract, Dealers, Jobbers, and Sales Representatives SHALL NOT be considered as eligible participants.

J. Without prejudice to others, the following contractors are considered qualified and do not need to submit contractor's qualifications.

Candela Controls
711 Business Park Blvd., Suite 101
Winter Garden, FL 34787
(407) 654-2420
Contact: Bill Ellis

MainStage
8761 A Ely Rd.
Pensacola, FL 32514
850-434-2080
Contact: Dean Sternke

Miami Stagecraft/ S.E.A.L. a Solotek company
12250 NE 13th Ct.
North Miami, FL 33161
(305) 891-1000
Contact: Steve Welsh

Murphy Lighting Systems
5113 Forsyth Commerce Rd
Orlando, FL 32807
(407) 895-7475
Contact: Chris Murphy

PART 2 - PRODUCTS

2.1 GENERAL

A. When this document lists several acceptable manufacturers for a particular item of equipment, more than one of which is to be provided, the Contractor shall furnish all of those similar items of equipment from one manufacturer.

B. All dimmer racks, dimmer modules, lighting controls and lighting consoles shall be from the same manufacturer.

C. Any item of equipment or hardware that may not be specifically shown on the drawings or specified herein, but required for proper system operation or installation, shall be furnished and installed and be of the highest quality available.

D. All materials and equipment used in this project shall be new, unused and of the latest models and design. Refurbished materials and equipment are not permitted except where noted.

E. The performance of all equipment must meet the most recently published manufacture's data sheet.

F. UL Labels: All equipment, where applicable standards have been established, shall be listed by Underwriters' Laboratories, Inc., and shall bear UL label when delivered to the job.

G. If so required by the local authority having jurisdiction, anything not arriving at the job bearing a UL label shall be field inspected and labeled by a nationally recognized testing laboratory recognized and approved by the local authority having jurisdiction.

2.2 ACCEPTABLE MANUFACTURERS

A. The stage lighting and control manufacturer shall be one who has been continuously engaged in the manufacture of stage lighting control equipment, wiring devices, and electronic dimmers for ten years or more.

B. Except where otherwise noted in this specification, the following are the approved manufacturers for the listed respective products:

Altman Lighting Inc.
57 Alexander Street
Yonkers, NY 10701
(914) 476-7987

Canto USA.
1092 West Atlanta Street SW
Suite300
Marietta, GA 30060
(888) 252-5912

Chauvet Professional
5200 NW 108th St.
Sunrise, FL 33351
(954) 577-4455

Elation Professional.
6122 S. Eastern Ave.
Los Angeles, CA 90040
(866) 245-7626

Electronic Theatre Controls, Inc.
3030 Laura Lane
Middleton, Wisconsin 53562
(800) 688-4116

LEX Products Corp.
401 Shippan Avenue

Stamford, CT 06902
(800) 643-4460

LynTec
8401 Melrose
Lenexa, KA 66214
(913) 529-2233

Lycian Stage Lighting
PO Box D
Kings Hwy
Sugar Loaf, NY 10981-0214
(845) 469-2285

Middle Atlantic Products, Inc.
North Corporate Drive
Riverdale, NJ 07457
(973) 839-1011

Pathway Connectivity
Acuity Brands Lighting
#103- 143917th Ave SE
Calgary AB T2G1J9, Canada
403-243-8110

Robert Juliat USA
48 Capital Dr.
Wallingford, CT 06492
(203) 294-0481

SSRC
11 Freedom Court
Greer, South Carolina 29650
(864) 848-9770

Vari-Lite/Strand
10911 Petal St.
Dallas, TX 75238
214-647-7880

C. Alternatives: In no case will equipment or materials of lesser design or workmanship be acceptable. Only those materials and equipment listed in this specification will be considered unless prior approval is sought and received.

1. Substitutions: When a specific piece of equipment specified has been discontinued and/or replaced by a new model, substitution will be acceptable when:

a. Submission of complete data on the new model or substitute has been approved by the owner prior to equipment acquisition.
b. Substitute equipment or the replacement of rejected equipment shall be at the sole expense of the contractor.

2. Substitutes shall be considered only when they are submitted fourteen days prior to bid date, and are accompanied by sufficient catalog data, specifications, and technical information for evaluation.

    a. Summarize proposal with a list of equipment catalog or series numbers. Substitute bids shall include a system riser diagram detailing components and any deviation of functionality from the drawings and specifications herein.
    b. The bidder shall include the name, address, and phone number of at least two- (2) factory authorized Field Warranty centers within a 250-mile radius of the job site as a part of the submittal documents.
    c. On the lighting fixtures, the bidder submitting other equipment shall include performance data taken and reported in compliance with the "Recommended Practice for Reporting Photometric Performance of Incandescent Filament Lighting Units used in Theatre and Television Production," approved as the official standard by the U.S. Institute for Theatre Technology, the Illuminating Engineering Society, the Society of Motion Picture and Television Engineers, and the American Theatre Association. For purposes of establishing the validity of such submissions, the manufacturer shall furnish this data from an independent testing laboratory. Proposals that fail to meet this requirement shall not be considered.
    d. On the dimming system, the bidder submitting other equipment shall include pertinent performance data, charts and drawings showing in what respect the system will function in accordance with specification, and in what way it will deviate from the specification. This submittal shall include, but not be limited to the following:

        1) Rated ampacity, peak single cycle surge current rating, I^2t rating, and transient voltage rating of the output devices employed in the dimmers.
        2) Laboratory verification of minimum current rise time at a 90-degree conductive angle, with the dimmer operating at the maximum load.
        3) Description of the air-cooling and air filtration systems.
        4) Description of the packaging and ease of replacement for all spare parts required in this specification.
        5) Original Manufacturer's catalog data sheets for all major components of the dimmer system.

    e. On the control system, the bidder shall submit the name of the manufacturer, and list of ten (10) or more operating systems in the State of Florida of the type specified which meet the performance control functions designed, with contact names and telephone numbers for references. This information shall be mandatory as a basis for determining the bidder's intent in meeting the full requirements of this specification and shall be submitted at least fourteen days in advance of bidding.
    f. It is understood that any additions or revisions of wiring required by using substitute equipment, whether such wiring is part of this contract or of the prime electrical contract, shall be the responsibility of the bidder making the substitution.
    g. If required by the Owner, the Consultant, or Architect, the bidder shall provide working samples of substitute equipment including lamps for any lighting fixtures, to be delivered to the premises designated for examination by Architects, Consultants, and such representatives as the Owner may direct. Handling, shipping and delivery to, or removal from site, of any sample required shall be at the cost of the Contractor. The Contractor shall be responsible for the arrangement of the cost of the electrical supply required to properly test any lighting instruments

or item of equipment. Proposals which fail to address specification requirements or review comments will be rejected.

h. Prior approval submittal review and approval shall not be considered to be shop drawing review. Prior approval in no way relieves the Contractor of responsibility to fully meet the requirements and intent of this specification.

i. Should the contractor propose and receive approval for the use of alternative or substitute equipment which requires additional or modified conduit, the contractor will be solely responsible for the installation of such conduit.

2.3 AUDITORIUM STAGE LIGHTING DIMMER BANKS

A. The dimmer rack shall be of modular design. The rack must be able to accept “slide in” dimmer modules and “slide in” control modules for easy installation and removal.

B. Furnish the dimmer racks and related equipment, see system one line drawing for quantities and device location drawing for placement.

C. ETC is the basis of design ETC is the basis for design, acceptable manufacturers are Vari-Lite Strand or an approved equal.

1. Electronic Theatre Controls, Inc.

CAT. #	DESCRIPTION
SR-48	Stage lighting dimmer racks. Sensor 3 dimmer rack configured for 96, 20amp circuits.
SR-24	Stage lighting dimmer racks. Sensor 3 dimmer rack configured for 48, 20amp circuits.
ETC Echo Relay Panel Feed through ERP-FT24	8 single pole 20A, 277V relays

2.4 AUDITORIUM STAGE LIGHTING DIMMER MODULES

A. The Dimmers shall be of modular design for easy installation and removal. Each module is equipped with two 2.4kw dimmers or relays, magnetic circuit breakers and a sealed power device assembly. The sealed power device assembly must be field replicable without soldering.

B. Furnish the dimmer modules, see system one line for quantities.

C. ETC is the basis of design ETC is the basis for design, acceptable manufacturers are Vari-Lite Strand or an approved equal.

1. Electronic Theatre Controls, Inc.

CAT. #	DESCRIPTION

D20	Stage lighting dimmer modules. Dual 20-amp status reporting dimmer modules for production dimming circuits
R20	Stage lighting dimmer modules. Dual 20-amp status reporting dimmer modules for production relay circuits
D20	One spare

2.5 AUDITORIUM STAGE LIGHTING CONTROL MODULES

A. The control electronics shall be of modular design. The unit must be “slide in” for easy installation and removal. The control electronics module must be field replaceable without disconnecting any control wiring.

B. Furnish the dimmer control modules; see system one line for quantities.

C. ETC is the basis of design ETC is the basis for design, acceptable manufacturers are Vari-Lite Strand or an approved equal.

1. Electronic Theatre Controls, Inc.

CAT. #	DESCRIPTION
CEM+	Stage lighting dimmer rack control module. Sensor 96 channel control module.
CEM+	Stage lighting dimmer rack control module. Sensor 48 channel control module.
CEM+	One spare with initial job configuration loaded into processor
ERn2 RM 120v	Rack mount External Control Enclosure with an architectural control processor and power module
P-ACP	Unison Paradigm Architectural Control Processor (ACP) for the control of house lighting
P-SPM	Unison Paradigm Station Power Module
	Ride thru power option to keep processor energized for up to 10 sec in short power outages
P-ACP	One spare with initial job configuration loaded into processor

2.6 AUDITORIUM STAGE LIGHTING MAIN LIGHTING CONSOLE

A. Furnish the main lighting control console and accessories.

B. ETC is the basis of design ETC is the basis for design, acceptable manufacturers are Vari-Lite Strand or an approved equal.

1. Electronic Theatre Controls, Inc.

QTY.	CAT. #	DESCRIPTION
1	ION XE 20	2048 output parameters
2	FW 20	20 Standard Fader Wing
2	-	19” ELO Touch Screen Monitors
2	-	15’ Network cable (console)
4	-	15’ DMX cable
1	ETC -Pad	For Remote Focus Unit
1	-	Console dust cover.
2	-	19” monitor dust covers
1	2 kVA UPS	Uninterrupted Power Source.
2	Littlite	Task lights
1	-	6’ extension cable
1	-	6 receptacle power strip

2.7 COMPUTER

A. Furnish a Dell Laptop computer (or equal) which meets all minimum requirements for console offline software package. Include console offline software package installed on laptop computer.

2.8 AUDITORIUM STAGE LIGHTING CONTROL CONNECTION PLATES

A. The system will be accessible via interconnection plates for the lighting control console and Ethernet/DMX 512 output receptacles located at the performance lighting positions. Furnish console plug in stations and lighting plugging stations; see contract drawings for type, quantities and locations.

2.9 AUDITORIUM HOUSE LIGHT CONTROL

A. General Description

1. Control shall be low-voltage type as specified here and as listed below and/or shown on the drawings. Controllers shall use low-voltage Class II electrical wiring. All controls shall be able to access and control house light dimmers.
2. Furnish and install the following equipment and accessories; see system one line for quantities and the device location drawing for placement.
3. Electronic Theatre Controls, Inc.

CAT. #	DESCRIPTION
U10001-x1F	Single button On/Off Entry stations inside keyed enclosure. Coordinate station color with architect.
-	keyed Locking cover for auditorium On/Off entry stations
P-TS7-E -P	7” screen Ethernet portable Master control station for control of house lighting, black
P-TS7-E-RM	7" Rack mount ethernet control station
UH10005	5 button station, preset 1-4 & off, coordinate color with architect

4. Electronic Theatre Controls is the basis for design, acceptable manufacturers are Vari-Lite/ Strand, Inc Vision Net.

2.10 EMERGENCY DMX BYPASS KIT

A. General Description.

B. Where required to trigger special-purpose lighting presets and bypass normal lighting controls during emergency or panic situations, the bypass means shall be the DMX Emergency Bypass Controller (DEBC 6). Electronic Theatre Controls is the basis for design ETC is the basis of design, acceptable manufacturers are Vari-Lite Strand or an approved equal.

C. Functional

1. The DMX Emergency Bypass Controller shall be capable of overriding a single universe of ANSI E1.11–2008, USITT DMX512-A control signals from “Normal” to “Bypass” when a trigger signal is detected via a two-pin trigger input.

    a. The DMX Emergency Bypass Controller shall output to six optically isolated DMX outputs
    b. The DMX Emergency Bypass Controller shall poll the bypass trigger input after a power loss and react upon start up
    c. The default or recorded preset shall be recalled immediately on restart if the trigger is also applied at restart
    d. Controllers that do not support E1.11–2008 compliant DMX communication shall not be acceptable

2. The DMX Emergency Bypass Controller shall be capable of recording a single DMX preset (snapshot) of 512 channels for recall during “Bypass” mode.
3. The DMX Emergency Bypass Controller shall be capable of recording a single DMX preset (snapshot) of 512 channels for recall during “Bypass” mode.
4. The DMX Emergency Bypass Controller shall have internally accessible, labeled DIP switches for configuration of:

    a. DMX record mode

b. Contact input type
c. Wait time for restore incoming DMX (bypass trigger removed).

5. The DMX Emergency Bypass Controller shall support a single bypass input using two modes.

a. Bypass triggering shall be supported via a maintained contact input configurable for normally open or normally closed operation.
b. The contact input shall be support +12VDC wet input to provide interface with the fire alarm or secondary triggering system.

D. Mechanical

1. The DMX Emergency Bypass Controller enclosure shall be a surface mounted enclosure constructed of 16-gauge, formed steel panels with a removable front cover.

a. Dimensions 9”H x 11” W x 2” D.
b. Enclosure located in dimmer room.

2. The DMX Emergency Bypass Controller enclosure shall provide discrete high and low voltage wiring compartments with voltage barrier.
3. The DMX Emergency Bypass Controller shall have a single test button accessible from the front of the enclosure without removing any panels.

E. Electrical

1. The DMX Emergency Bypass Controller shall be completely internally pre -wired by the manufacturer.
2. The DMX Emergency Bypass Controller shall support 100 to 277-volt input power, 50/60Hz, 150 mA maximum current.
3. The DMX Emergency Bypass Controller shall internally switch from the normal DMX input (pass through) to the bypass DMX output using electromechanical relays when triggered.
4. The DMX Emergency Bypass Controller shall be UL and cUL Section 924 Listed for interaction with similarly listed products

2.11 EMERGENCY BYPASS DETECTION

A. General Description

1. The emergency bypass detection kit monitors a normal power feed in single and three phase systems and generates a maintained contact closure upon loss of power to trigger the UL924 listed emergency bypass operation.
2. Electronic Theatre Controls is the basis for design alternative manufacturers are Strand Lighting Inc. or an approved equal.
3. Furnish and install the following equipment and accessories; see system one line for quantities and the device location drawing for placement.
4. Electronic Theatre Controls is the basis for design, acceptable manufacturers are Vari-Lite Strand or an approved equal.

B. The Enclosure shall be a surface mounted, constructed of 16-guage formed steel panels removable front cover finished in fine textured, scratch-resistant, powder coat paint.

1. Dimensions are 10.5” H x 14” W x 4.2” D.
2. Enclosure located in dimmer room.

C. Emergency Bypass Detection enclosures shall support 100-to-277-volt configurations.

D. EBDK enclosures shall be field configurable for single-phase, bi-phase, and three-phase operation without the need for additional components.

E. The Emergency Bypass Detection Kit shall be completely pre-wired by the manufacturer. The contractor shall provide input feed and control wiring.

F. All control wire connections shall be terminated via factory-provided connectors.

1. The Bypass Detection Kit shall be UL and cUL Section 924 Listed for interaction with similarly listed dimming and switching panels.

2.12 DMX DISTRIBUTION & ETHERNET WIRING

A. Furnish equipment as shown on system drawing.

B. Install a **CERTIFIED** CAT 6 network.

1. All branches will be fully tested and documented using a Certified CAT 5E tester and copies of the test documentation shall sent to the consultant for review.
2. All Components (wire, connectors, inline couplers, patch bay, patch cords, etc.) shall be fully CAT 6 compliant.

C. Install the following hardware, when quantities above those shown on the system drawing are called for, those extras shall be furnished as loose equipment.

1. DMX/RDM rack mount Four port Gateway configured as output node
   a. ETC N34G-4F
   b. ETC is the basis for design, acceptable manufacturers are Pathport or an approved equal.

2. HUB-1&2 24 port minimum managed gigabit network switches with PoE. PoE power to be sufficient to support all devices that are connected.
   a. 3Com or similar

3. PBY-1 & PBY-2 Network Patch bays. 24 port RJ45. Provide the required number of modular outlets. Include labeling.
   a. Siemon HD5-series or similar

4. Wireless Access Point (WAP) with single point Setup.
   a. HP JL062A Dual Radio 801.11a/b/g/n/ac Wireless Access point or equal.

5. Uninterrupted Power Supply - rack mount
   a. Middle Atlantic Products model # UPS-2200R uninterrupted power supply 120v input/120v output, extended runtime model with switched outlet groups to connect critical equipment to a switched outlet group configured to turn on immediately in the event of a power outage and to connect peripheral equipment to a group

configured to shut down after a short period in the event of a power outage in order to conserve battery run time (or Equal)

b. Middle Atlantic UPS-EBPR 120v external Battery pack (or equal).

6. Forty (40) 3’ CAT 5e patch cords
   a. Black Box EVSA85-000 or similar.

7. Portable Nodes
   a. DMX portable nodes with c-clamp and safety cable to distribute DMX over Ethernet with any compatible input or output device. Supports CAN, RDM, and USITT DMX 512-A, compliant with 802.af for Power over Ethernet, flexible output patch to allow a 512-address universe to begin at any output address. Fabricated from 16-gauge cold roll steel finished in black, fine textured scratch resistant powder coat, two integrated DMX 5 pin out ports, back lit LCD display for identification. Front and rear power indicators and RJ45 receptacle for connection to the lighting network.
   b. Pathport two port gateway is the basis of design; Electronic Theatre Control is an approved equal
8. One wall mount equipment rack for Auxiliary Rack 1. Furnish swing open access wall mount auxiliary rack as indicated on drawing. Furnish rack back box to electrical contractor and coordinate installation. Provide internal power as required. Fill all unused rack spaces with blank panels.
   a. AR-1: Middle Atlantic Products DWR-24-26 with FD-24 front door.
   b. Furnish and install equipment in the AR-1 rack see contract drawings for location and quantities:
   c. Middle Atlantic is the basis for design; acceptable manufacturers are Hoffman, and Rittal.

2.13 LIGHTING CONNECTOR STRIPS

A. This assembly shall be fabricated of 16-gauge, cold-rolled steel with removable covers and shall be 4" x 4" in cross section in lengths specified herein. Terminal strips shall be supplied for feed and wire extending to 18" long pigtails, except where noted differently, which shall be 3-conductor type SO cable. The pigtails shall be securely fastened to housing body by means of strain relief clamps. Strip finish shall be fine-texture, scratch resistant, black powder-coat. One “double pipe hanger” steel hanging bracket or as required through coordination with Stage Rigging Contractor shall be supplied for each 5-foot section of connector strip with a minimum of 2 brackets per strip. The terminal blocks shall be a barrier screw clamp type. Strips with 12 or more circuits shall have terminals located in an auxiliary terminal box sized as specified. Outlets and pigtails shall be identified by 2" high numerals on both sides of the connector strip, black on white for dimming circuits, red on white for non-dimming circuits. Wire nuts and crimped connectors are not acceptable. The entire connector strip assembly shall be UL listed and labeled.

B. Furnish the following connector strips / cable Panto-graph assemblies:

1. One (LCS-1,) at approximately 34 feet long with Black female L5-20 twist lock connector on18” pigtails for 20A, 120v dimming circuits and black Edison connectors with 18" pigtails for 20A, 120v relay circuits, two DMX node with female flush mount DMX 5 pin receptacle. Furnish the necessary mount brackets to attach the connector strip to the

movable lighting battens. There shall also be a network cable included in the Panto-graph cable loom.

2. One (LCS-2,) at approximately 34 feet long with Black female L5-20 twist lock connector on 18" pigtails for 20A, 120v dimming circuits and black Edison connectors with 18" pigtails for 20A, 120v relay circuits, two DMX node with female flush mount DMX 5 pin receptacle. Furnish the necessary mount brackets to attach the connector strip to the movable lighting battens. There shall also be a network cable included in the Panto-graph cable loom.
3. One (LCS-3,) at approximately 59 feet long with Black female L5-20 twist lock connector on 18" pigtails for 20A, 120v dimming circuits and black Edison connectors with 18" pigtails for 20A, 120v relay circuits, two DMX node with female flush mount DMX 5 pin receptacle. Furnish the necessary mount brackets to attach the connector strip to the movable lighting battens. There shall also be a network cable included in the Panto - graph cable loom.
4. One (LCS-4,) at approximately 59 feet long with Black female L5-20 twist lock connector on18" pigtails for 20A, 120v dimming circuits and black Edison connectors with 18" pigtails for 20A, 120v relay circuits, two DMX node with female flush mount DMX 5 pin receptacle. Furnish the necessary mount brackets to attach the connector strip to the movable lighting battens. There shall also be a network cable included in the Panto - graph cable loom.
5. One (LCS-5,) at approximately 59 feet long with Black female L5-20 twist lock connector on18" pigtails for 20A, 120v dimming circuits and black Edison connectors with 18" pigtails for 20A, 120v relay circuits, two DMX node with female flush mount DMX 5 pin receptacle. Furnish the necessary mount brackets to attach the connector strip to the movable lighting battens. There shall also be a network cable included in the Panto - graph cable loom Final connector strip length and Panto-graph travel will be determined in coordination with the stage equipment supplier during shop drawings

2.14 PANTOGRAPH CABLE MANAGEMENT:

A. Pantograph shall accommodate up to (64) 12 Ga conductors and up to (2) data cables.

1. Up to (8) 8 conductor flat cables: Maximum capacity of (24) 120 Volt, 20-amp circuits utilizing (1) 12 Ga ground conductor for every (2) 20-amp circuits.
2. Data Cable: Data cable shall be CAT6.

B. Pantograph shall be constructed with a physical barrier between the power supply and data cables within the channel.

C. The pantograph shall consist of a series powder coated aluminum channels hinged to each other to allow the entire distance of travel required by the batten, up to a 52 feet (15.8 m) fully extended length.

D. The top arm shall be connected to a moving trolley.

E. Pantograph shall fit between lift lines spacing greater than 8 feet -6 inch (2591 mm) and less than 11 feet - 0 inch (3353 mm).

F. Pantograph fully retracted height shall be no greater than 25 inch (635 mm) vertical.

G. Pantograph shall mount to a 1.5-inch (38 mm) schedule 40 pipe batten.

H. Pantographs shall travel at a maximum speed of 30 feet per minute (9 meters per second).

I. System includes power and data strain reliefs for top and bottom.

J. The system shall include grid junction box to be installed by electrical contractor

2.15 AUDITORIUM STAGE LIGHTING PLUGGING BOXES

A. Surface Mount Outlet boxes are fabricated from 16-gauge steel with a fine-textured, scratch-resistant, powder-coat finish. Outlets are 3-pole grounding of 20A grounded flush mount L5-20 female twist lock connectors for 120V dimming circuits and 3-pole grounding of 20A grounded flush mount Edison female connectors for 120V relay circuits Circuits are individually indicated with ¾" white die cut adhesive labels, black on white for dimming circuits, red on white foe relay circuits. Boxes are equipped with ground lugs. All faceplates match outlet box enclosure dimensions with no sharp edges exposed. Basis of design is ETC alternative manufacturers are SSRC, LEX or an approved equal.

B. Flush Mount Outlet boxes are fabricated from 16-gauge steel with a fine-textured, scratch-resistant, powder-coat finish. Outlets are 3-pole grounding of 20A grounded flush mount L5-20 female twist lock connectors for 120V dimming circuits and 3-pole grounding of 20A grounded flush mount Edison female connectors for 120V relay circuits. Circuits are individually indicated with ¾" white die cut adhesive labels, black on white for dimming circuits, red on white foe relay circuits. Boxes are equipped with ground lugs. All faceplates match outlet box enclosure dimensions with no sharp edges exposed. Basis of design is ETC alternative manufacturers are SSRC, LEX or an approved equal.

C. Furnish the plugging boxes for performance lighting circuits; see distribution detail drawing for circuit designations and quantities and see device location drawing for locations.

2.16 GRID IRON JUNCTION BOXES

A. Coordinate with the stage rigging contractor and division 26 contractors. See lighting device location and system one-line drawings for placement and quantities, and distribution detail drawings for circuit designations.

2.17 BACK BOXES

A. The following back boxes are furnished by the lighting contractor for installation by the electrical contractor:

1. AR-1 enclosure for auxiliary lighting rack located in dimmer room.
2. BSCP enclosure for auxiliary lighting rack located on stage.
3. DEBC6 enclosure for emergency DMX source located in dimmer room.
4. EBDK enclosure for phase lose detection.
5. GIJB enclosure stage lighting circuits to LCS over auditorium and over stage.
6. HR enclosure for house lighting feed thru circuits located in dimmer room.
7. LN1S enclosure for lighting network nodes surface mount devices on front of house catwalk.

8. LR1S enclosure for lighting network surface mount devices on front of house catwalk and on stage.
9. LR2S enclosure for lighting network surface mount devices over stage.
10. PB surface mount enclosures for PD circuits located on front of house catwalk and Torm side lighting positions.
11. PD enclosures for stage lighting dimmers are located in dimmer room.

2.18 AUDITORIUM STAGE LIGHTING FIXTURES

A. All theatrical lighting fixtures are to include a C-clamp, a color frame, a safety cable w/spring clip, 36" 3-wire leads and 20A grounded L5-20 twist lock male connector installed except where noted differently

B. All LED lighting fixtures are to include a C-clamp, a safety cable w/spring clip, a 6' male Edison connector to instrument power cable (plug type for power input at instrument is determined by manufacturer),

C. All moving lights are to include pipe clamps, safety cable w/ spring clip, a male Edison to instrument power cable and a 10' DMX male 5 pin to female DMX 5 pin thru jumper cable.

D. All fixtures of a similar type shall be from the same manufacturer (e.g., All ellipsoidal type fixtures, all fixed LED wash fixtures etc.) unless noted otherwise.

E. Furnish and install the following theatrical lighting fixtures in the auditorium: see light plot for locations and quantities.

QTY.	CAT. #	DESCRIPTION
	Electronic Theatre Controls, Inc. Cat. # 419 OR An approved equal	Nineteen-degree, fixed angle beam, 115-volt 750-watt ellipsoidal reflector spotlights.
	Electronic Theatre Controls, Inc. Cat. # 426 OR An approved equal	Twenty-six-degree, fixed angle beam, 115-volt 750-watt ellipsoidal reflector spotlights.
	Electronic Theatre Controls, Inc. Cat. # 436 OR An approved equal	Thirty-six-degree, fixed angle beam, 115-volt 750-watt ellipsoidal reflector spotlights.
	Electronic Theatre Controls, Inc. Cat. # PAR-EA An approved equal	Source Four Par ,750 watt w/ lenses set
	ROGUE R3X Wash LED Zoom is the basis of design. OR Acceptable manufacturers are Vari-Lite Strand, Elation Professional, High End Systems.	RGBW moving head LED wash light with 37 25w LEDs, with universal power supply 100-240 VAC, 12-49 deg zoom, strobe,3pin/5pin DMX in/out, 21/62/71/107 DMX channels
	COLORado 2 -Quad Zoom OR Acceptable manufacturers are, Elation Professional,	-Light Source: 14 LEDs (quad-color RGBW) 15 W, -Beam Angle: 7° to 29°

	Electronic Theatre Controls, Inc	-Field Angle: 14° to 44° -Zoom Angle: 14° to 44° -Color Macros: 20 macros Dimmer: Electronic -Shutter/Strobe: Electronic -Zoom: Motorized -Strobe Rate: 0 to 20 Hz -Power Linking: 7 units @ 120 V;
	Chauvet Maverick MK3 Spot OR Acceptable manufacturers are Vari-Lite Strand, Elation Professional, High End Systems	Maverick MK 3, 820W LED, CRI 75, 51,000 source lumens, -6° - 45° zoom angle / frost effect, Pan and Tilt: 540°/270° -Pan and Tilt Ranges: 540°, 360°, 180° pan/270°, 180°, 90° tilt -Colors: 6 + white, split colors, continuous scroll at variable speeds -Colors: CMY flags, CTO flag, CRI filter, color correction -Gobos (1): 7 + open (7 glass), rotating, interchangeable, indexing, slot-n-lock, continuous scroll at variable speeds -Gobos (2): 7 + open (7 glass), rotating, interchangeable, indexing, slot-n-lock, continuous scroll at variable speeds -Gobos (3): 8 + open (8 metal), 2 rotating, 1 static gobo wheel. -Gobo Size: Gobo Wheel 1 (rotating): 30 mm (outside), 23 mm (image), 1.1 mm (max. thickness) -Gobo Size: Gobo Wheel 2 (rotating): 30 mm (outside), 21 mm (image), 1.1 mm (max. thickness) -Gobo Size: Gobo Wheel 3 (static): 160 mm (outside), 22 mm (image), 0.8 mm (max. thickness) -Effect Wheel: 1 effects -Dimmer: Electronic -Shutter/Strobe: Electronic

		-Zoom: Motorized -Focus: Motorized -Frost 1: Light Frost - Motorized -Frost 2: Medium Frost - Motorized -Iris: Motorized -Prism: 5 Linear facets, motorized, rotating -Prism: 5 Circular facets, motorized, rotating -Strobe Rate: 0 to 25 Hz -Move in black
	Chauvet Mavrick Force 2 Profile OR Acceptable manufacturers are Vari-Lite Strand, Elation Professional, High End Systems.	-Light Source: Osram Sirius 580W LED, -Color Temperature (at full): 7,055 K, CRI: 70.8 -Beam Angle: 6.8° to 48° -Field Angle:7.6° to 54.9° -Colors: CMY flags, CTO flag, -Gobos (1): 7 + open (7 glass), rotating, interchangeable, indexing, slot-n-lock, continuous scroll at variable speeds -Gobos (2): 7 + open (7 glass), rotating, interchangeable, indexing, slot-n-lock, continuous scroll at variable speeds -4 rotating electronic framing shutters -Prism: 5 Circular facets, motorized, rotating -Colors: 7 + white, split colors, continuous scroll at variable speeds
	Chauvet MK3 Profile is basis of design OR Acceptable manufacturers are Vari-Lite Strand, Elation Professional, High End Systems	--Light Source: 1 LEDs (CW) 820 W, (24 A), 7,450 K, 50,000 hours life expectancy -Color Temperature (at full): 7,441 K, CRI: 73 -Pan and Tilt: 540°/270° -Pan and Tilt Ranges: 540°, 360°, 180° pan/270°, 180°, 90° tilt -Colors: 6 + white, split colors, continuous scroll at variable speeds

		-Colors: CMY flags, CTO flag, CRI filter, color correction -Gobos (1): 7 + open (7 glass), rotating, interchangeable, indexing, slot-n-lock, continuous scroll at variable speeds -Gobos (2): 9 + open (9 glass), continuous scroll at variable speeds -Effect Wheel: 1 effect -Framing Shutters: Yes -Dimmer: Electronic -Shutter/Strobe: Electronic -Zoom: Motorized -Focus: Motorized -Frost 1: Light Frost - Motorized -Frost 2: Medium Frost - Motorized -Iris: Motorized -Prism: 5 linear facets, motorized, rotating -Prism: 5 Circular facets, motorized, rotating -Strobe Rate: 0 to 25 Hz -Move-in-Black: Yes
	Altman Spectra CYC 200 LED Cyc Light is the basis of design OR Vari-Lite Strand, Elation Professional, Electronic Theatre Controls, Inc	-Output: 7534 Lumens (RGBA) -Beam Spread: 40° Vertical / 80° Horizontal -Materials: Construction is corrosion-resistant materials and hardware. -Housing: Lightweight aluminum fabrication. -Light Engine: 200 Watts Max at full RGBA -Reflector: Proprietary curve, specular aluminum -Rating: Multi-Voltage; 100-240 VAC operation -Data Ports: 1 Male & 1 Female flush mount 5-Pin XLR -Power Cable: 5-foot, PowerCON in and standard connector. -AC Out: Flush mount PowerCON for feed thru

		power to other Spectra Cyc units only. A maximum of 6 Spectra Cyc 200 fixtures per power daisy chain
	Robert Juliat- Topaz Follow spot OR Lycian #1274 – Superstar Short OR	Throw 80'-125' spot 1200w hot strike discharge, 7/14.5 zoom Include base and color boomerang.
	Lycian 1280 Superstar LED or Altman AFS-700-B follow spot	

2.19 AUDITORIUM STAGE LIGHTING LAMPS

A. Approved manufacturers for stage lamps are General Electric, Sylvania, or Ushio.

B. Furnish and install the following stage lamps for the auditorium stage lighting fixtures in the necessary quantities plus 20% (minimum of 2) for spares:

1. HPL750/115X, for ETC ellipsoidals and Pars,
2. Two (2) 1200-watt MSD for Robert Juliat- Topaz. or 1200w HMI Truss Trouper, HMI1200w double ended lamp for Lycian #1274 Superstar Short.

C. Turn over ALL spare lamps to the Owner.

2.20 AUDITORIUM STAGE LIGHTING ACCESSORIES

A. Furnish the following stage lighting accessories for the auditorium.

B. Lex Stage cable is the basis of design or an approved equal.

C. Provide all type S L5-20 jumpers and twofers required to cable the light plot and furnish the following jumpers. All jumpers are to have color coded length labeling at both ends of the cable.

1. 10 @ 5'-0", 12 AWG, type S extension cables w/male and female L5-20 connectors installed.
2. 10 @ 10'-0", 12 AWG, type S extension cables w/male and female L5-20 connectors installed.
3. 5 @ 25' -0", 12 AWG, type S extension cables w/male and female L5-20 connectors installed.
4. 2 @ 50' -0", 12 AWG, type S extension cables w/male and female L5-20 connectors installed.
5. 10 @ 2-Fers, Lex Products two-fer with w/male and female L5-20 connectors.

D. Provide all type S Edison jumpers and twofers required to cable the light plot and furnish the following jumpers. All jumpers are to have color coded length labeling at both ends of the cable.

1. 5 @ 5'-0", 12 AWG, type S extension cables w/male and female Edison connectors installed.
2. 5 @ 10'-0", 12 AWG, type S extension cables w/male and female Edison connectors installed.
3. 5 @ 25' -0", 12 AWG, type S extension cables w/male and female Edison connectors installed.
4. 2 @ 50' -0", 12 AWG, type S extension cables w/male and female Edison connectors installed.
5. 10 @ 2-Fers, Lex Products two-fer with w/male and female Edison connectors

E. Provide all 5 pin DMX jumpers required to cable the light plot and furnish the following jumpers. All jumpers are to have color coded length labeling at both ends of the cable.

1. (5) 5-Pin Male to 5-Pin Female XLR DMX Cable @ 5 foot
2. (5) 3-Pin Male to 3-Pin Female XLR DMX Cable @ 5 foot
3. (5) 5-Pin Male to 5-Pin Female XLR DMX Cable @ 10 foot
4. (5) 3-Pin Male to 3-Pin Female XLR DMX Cable @ 10 foot
5. (2) 5-Pin Male to 5-Pin Female XLR DMX Cable @ 25 foot
6. (2) 3-Pin Male to 3-Pin Female XLR DMX Cable @ 25 foot

F. Fixture Accessories

1. Barn doors as shown on light plot
2. 6 top hats
3. 6 Half hats
4. 10 donuts.
5. 1 roll black wrap
6. All gel shown on the light plot.
7. In additional to all gel shown on light plot furnish one hundred (100) additional sheets assorted color media as follows:

    a. 6 sheets Roscolux 33
    b. 6 sheets Lee 202
    c. 8 sheets Roscolux 119
    d. 4 sheets Roscolux 54
    e. 8 sheets Lee 152
    f. 1 sheet Lee 203
    g. 8 sheets Roscolux 68
    h. 4 sheets Roscolux 55
    i. 4 sheets Roscolux 52
    j. 4 sheets Roscolux 364
    k. 2 sheets Roscolux 114
    l. 10 sheets Roscolux 81
    m. 10 sheets GAM 685
    n. 10 sheets GAM 235
    o. 5 sheets Roscolux 321
    p. 5 sheets Roscolux 385
    q. 5 sheets Roscolux 39
    r. Confirm gel colors with owner

8. Ten (10) Pattern Holders for ellipsoidal spotlights.
9. Patterns as follows:

10. 8 GAM #222

    a. 8 GAM #294
    b. 2 GAM #201
    c. 2 GAM #204
    d. Confirm patterns with owner

11. (Quantity of 1) Stage Haze Generator (Water Based) w/

    a. Power: AC 120V 60Hz
    b. Output: 2,800 cu. ft. / min.
    c. Fluid Tank Capacity: 2.5 L
    d. Low Fluid Consumption Rate: +20 hours continuous work / per liter
    e. LCD Timer Panel Controller On-board Included
    f. Compact Flight Case Included
    g. Air Pressure: 30 Psi
    h. Weight: 31.5 kg
    i. Dimensions (mm): L510 x W 375 x H 350
    j. Liquids Used: Water Based Haze Fluid (Only)
    k. On-board 5-pin DMX
    l. Low noise: Below 70dB at 10 cm distance.
    m. Extremely Small Particle Generation w/ Long Hang Time
    n. Metal Net Filter
    o. Provide with 12 gallons of Haze Fluid
    p. Provide the following:
        1) Basis of design: Antari HZ 500l
        2) Subject to compliance with requirements, an equal from:
            a) Jem

2.21 AERIAL WORK PLATFORM

A. General: Provide an aerial work platform to access the over stage theatrical lighting battens to focus stage lighting fixtures and light duty work on stage equipment and stage scenery.

B. The Genie Lift model # AWP-30S is the basis of design.

C. Measurements:
1. 35’-6” working height.
2. 29’-6” platform height.
    a. Standard gated platform
3. 2’-5” standard base width.
4. Up to 350 lbs. lift capacity.

D. Productivity
1. Auxiliary platform lowering.
2. Rocker base system for maneuverability.
3. Easily rolls through standard doorways.
4. AC power to platform.
5. Dual activated up/down switch.
6. Small outrigger footprint.
7. Wide rear access forklift pockets.

8. LED lights indicate outrigger installation.
9. Descent light and alarm package

E. Power: Ac power 110V/50-60 Hz

PART 3 - EXECUTION

3.1 STANDARDS COMPLIANCE

A. Comply with all local building codes.

B. In the absence of specific local codes, comply with the National Electrical Code (NFPA-70) as applicable to installation and construction of stage lighting and control equipment.

C. Where not in conflict with local building codes or the National Electrical Code comply with industry standard professional practices.

D. Installation practices shall be in accordance with OSHA Safety and Health Standards.

3.2 SHOP DRAWINGS

A. Submit within thirty (30) days of the bid acceptance, for review and approval by the Owner, Architect, and Consultant:

B. Complete shop drawings and data sheets for all items specified.

C. Complete shop drawings for all components, assemblies, sub-assemblies, cabinets, wiring devices and hardware required to implement the work.

D. Riser diagrams showing all quantities, types and sizes of inter-connection wires to be installed by others.

E. Schematics of all block assemblies and sub-assemblies, including pin out identification of all low voltage cable connectors.

F. Approval of shop drawings does not relieve the Contractor of the responsibility of providing equipment in accordance with these specifications. Any deviations from the specifications shall be "starred" and noted in 1/4" high letters. Only deviations which upgrade the quality of the equipment shall be considered.

G. In addition to drawings, the Contractor may elect to submit catalog cuts for certain standard equipment items. These shall contain full information on dimensions, construction, applications, etc. to permit proper evaluation. In addition, they shall be properly identified as to their intended use and any options or variations shall be clearly noted.

H. Samples may be requested by the Architect and shall be furnished for inspection at the Architect's office, at the Contractor's sole expense.

I. Prior to the commencement of fabrication and delivery, the Contractor shall submit for approval, to the Architect, an outline of a proposed commencement and completion schedule of project requirements.

3.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver stage lighting equipment and controls to job site securely wrapped in containers.

B. Coordinate delivery dates with the Division 26 contractor

C. All equipment shall be stored in a clean, dry space.

D. Discrepancies in quantities or missing equipment shall be noted, in writing, and brought to the attention of the manufacturer within five days of receipt.

E. Replacement of missing or damaged equipment shall be the responsibility of the Contractor.

F. Handle equipment and controls carefully to prevent breakage, denting and scoring finish.

G. Replace and return damaged units to equipment manufacturer immediately.

H. Store in original cartons and protect from dirt, physical damage, weather, and construction traffic.

3.4 INSTALLATION

A. The Contractor shall furnish, deliver, install and terminate all system control wires.

1. All cables shall be permanently labeled at every termination. The label shall not be handwritten. Clear heat shrink shall cover the label.
2. Service loops of not less than 6" will be present at all terminations to equipment.
3. All pulls to be made by hand, care will be taken not to nick cable jackets, and any nicked or damaged cable will be replaced.
4. A pull string will be left in all conduits after wire is installed.
5. NO SPLICES WHATSOEVER IN CONDUIT!
6. Include spare cables with all field runs. Quantity to be 10% or 1 whichever is greater unless otherwise specified.
7. Where shielded cable is in use leave shield drain wire the same length as the circuit conductor(s), sleeve shield drain wire in green PVC tubing. Cap where the cable jacket was removed with heat shrink. Where the shield drain wire is to be lifted follow the above and fold back over cable jacket. Then cap end with heat shrink. Do not use a single piece of heat shrink for this use two smaller ones.
8. All soldering will be clean and neat and not exhibit evidence of a " cold" joint, where necessary heat sinks will be used. Use only rosin core "electronic type" solder.
9. Wire nuts will be not allowed.

B. The Contractor shall furnish and install all system control devices.

C. The Contractor shall hang and aim the stage fixture hanging plot.

1. Provide the Theatre Consultant with fourteen (14) days' notice prior to this work being scheduled.
2. The Theatre Consultant shall verify the aiming of the stage fixtures.

D. The installation of all work shall be neat.

E. All boxes, equipment, etc. shall be plumb and square.

F. The installation shall conform to the plans and specs.

G. The contractor shall not commence the installation of equipment and devices, other than the pulling of cable, until all areas are clean, painted and finished to a point that they are completely dust, dirt, lint, fiber and airborne particle free. The air conditioning system must be operating to its design level and be able to keep all areas with control equipment stable.

3.5 INSTALLATION COORDINATION

A. The Contractor shall specifically coordinate the placement and sizes of conduit relating to this work and shall specifically review and approve the conduit rough-in in time to advise all parties of needed changes, omissions, etc.

B. The Contractor shall report this successful coordination in writing to the Architect.

C. If any conflicts or omissions occur as a result of the Contractor's unsuccessful coordination of the above-mentioned work, it shall be the Contractor's responsibility to correct, furnish and install any additional material that may be required.

D. The contractor shall at all times coordinate his work with the other trades to ensure smooth progress of work and satisfactory final results.

E. The Contractor shall examine areas and conditions under which stage lighting and controls are to be installed and notify the Architect in writing of conditions detrimental to proper installation and operation.

3.6 INSPECTION AND TESTING:

A. During the installation of the equipment the contractor shall arrange for access as necessary for inspection of equipment by the owner's and/or architect's representatives.

B. Provide a safe means of accessing all system components for all visits.

C. Equipment Pretesting: All racks are to be built and wired in the contractors' shop and tested prior to delivery to site. All other equipment is to be tested prior to delivery and installation. A written test report will be submitted to the owner.

D. Final Inspection:

1. The final inspection will confirm that the systems, as installed, meet the requirements of this spec, the contract documents, and the approved contractor's shop drawing and submittals.

2. The contractor will inform the owner in writing of the system's completion. The contractor will then request final inspection by the consultant and carry out the necessary coordination. This coordination includes:

    a. Giving at least fourteen days' notice to the consultant prior to the final inspection.
    b. Arranging for the contractors and consultants exclusive use of the space.
    c. Arranging for an HVAC technician to be available to turn the AC system on and off as required.
    d. Arranging for a sound technician to be available to control the sound system as required.
    e. The contractor's job foreman and one additional worker familiar with the job will be present during all check out, testing and inspection.

3. Contractor will complete the following tasks prior to consultant's arrival:

    a. Unpack and assemble all portable equipment.
    b. Place all portable equipment in one location.
    c. If anything has been turned over to the owner have the signed Letters of Transmittal on site.
    d. Complete all required paperwork (pre-testing reports, letters indicating successful coordination of the installation, etc.).
    e. Provide all lighting network certification reports.
    f. Remove all security covers.
    g. Contractor will provide all necessary software, cables, and interfaces to facilitate the setting of computer controlled, remote controlled or digitally controlled equipment.

4. Contractor will provide the following test equipment for use during inspection and acceptance testing:

    a. Some type of light meter
    b. Some type of DMX checking device
    c. Some type of Multi-meter.
    d. The contractor will provide safe means to access all system components during the entire commissioning process.
    e. The contractor shall provide personnel and equipment to make any adjustments to the theatrical lighting system(s), as well as to correct problems, for the entire inspection and testing period.

E. The Theatre Consultant or his representative will conduct all the final system tests in order to determine final acceptance.

F. In no event shall the theatrical lighting systems installation be submitted for final approval or acceptance until any and all elements of the facility that may have a bearing on the system performance, including but not limited to doors, windows, HVAC, carpeting, furniture, wall coverings, stage flooring, rigging systems, interior design elements, architectural lighting and lighting control systems have been completed and are operable. All elements that may affect stage lighting systems operation or performance shall be "on" and operating during adjustments. The stage lighting contractor will be responsible for coordinating the requirements of this paragraph with other work on the project.

G. Equipment Backorders. Should any component or equipment be on backorder at the time of system inspection and testing the contractor shall provide comparable loaner equipment at the contractor's expense. Said equipment shall remain on-site until backordered equipment is delivered and installed.

3.7 MANUFACTURER'S SERVICES

A. The Contractor shall provide for:

1. A manufacturer's field service engineer to perform initial system activation. Under no circumstances shall power be applied to any equipment prior to initial system activation.
2. The manufacturer's field service engineer shall inspect and confirm that all low voltage terminations are correct.
3. Such engineering services shall be furnished within twenty-one (21) days of a written request by The Contractor.

3.8 TRAINING AND INSTRUCTION

A. The Contractor shall provide sixteen (16) hours of onsite instruction to Owner designated persons. This instruction shall happen on four occasions. The general conditions require all training sessions to be videotaped. This contractor is to coordinate with this requirement and if required perform the taping.

1. The first occasion shall take place at the time of initial system activation and be performed by the manufacturer's field service engineer. The duration of this occasion shall be not less than three (3) hours. This instruction shall cover all aspects of operation and maintenance required by this system.
2. All other occasions shall be coordinated with the owner representative and Contractor with (21) days written notice. This instruction shall be an overall review of the system operation and detailed console operations. The finial occasion shall take place within the first six months following system activation.

B. Provide operational assistance for the first usage of the system. This is to be on the owner's time schedule but, not to exceed 8 hours.

3.9 MANUALS

A. Upon completion of the work, the Theater Equipment Contractor shall submit four detailed printed copies of Operations and Maintenance Manuals for each space, 2 for the Owner, and 1 for the Architect/Engineer of Record and one for Consultants. The Contractor shall also provide CD-ROM's with the Operations and Maintenance Manuals in PDF form with a hyper link table of contents, also any and all CAD drawings including as-built shop drawings, equipment descriptions, network certification certificate, any required certificates or warranties, and parts lists or other electronically produced submittal items.

B. The contractor shall also provide a USB flash drive for each space with all project documents including the initial configuration files for;

1. The control electronics modules for the stage lighting dimmers and house light dimmers,

2. The stage lighting consoles.
3. The stage lighting network switches and the portable network nodes.
4. All multi parameter stage lighting fixtures. Submit in quantities and file formats as required by the Architect

C. Additionally, inside the primary dimmer or auxiliary control rack, provide a document pouch and one set of final as-built drawings. Before distribution of manuals submit one copy to consultant for approval. Each manual is to contain the following:

1. System one-line drawings including all labeling and changes (“as builts “).
2. Owner’s manual for each piece of equipment.
3. Schematic diagram for each piece of equipment.
4. Contractors service phone numbers in a conspicuous place.
5. All test reports.

3.10 WARRANTIES

A. Contractor will warrant the system to be free from defects in materials and workmanship for a period of one year from the date of acceptance, or first beneficial use, whichever comes first. Acts of god and owner abuse or neglect are not covered.

B. During the warranty period the contractor will respond to and correct any call for service within one day of the call.

C. Loaner equipment will be provided if necessary.

D. The manufacturer of the stage lighting and control equipment shall warranty the electrical distribution, dimming and control equipment to be free from defects of material or workmanship for a period of two years from the date of acceptance.

E. The manufacturer shall warranty all fixtures and accessories (except lamps) to be free from defects of material or workmanship for a period of one year from the date of acceptance. During the period of this warranty, equipment that proves to be defective shall be repaired or replaced at no charge (excluding freight). Unauthorized local repairs of equipment during the warranty period shall relieve the manufacturer of his responsibilities under this warranty.

F. Include the name, address, and phone number of at least two- (2) factory authorized Field Warranty centers within a 250-mile radius of the job site in the operation and maintenance manual.

3.11 FINAL ACCEPTANCE

A. The following conditions must be met before final acceptance will be granted:

B. Inventory of all equipment by the project Architects or his representative.

C. All inventoried portable equipment is in secure storage, accessible only by the Owner.

D. Approval of final tests and inspections by the project Architects, Theatre Consultant, and Owner.

E. Submittal to the Architect of three (3) signed copies of the warranty(ies).

F. Satisfactory completion of all punch list items.

G. At the date of system activation, the Contractor shall furnish and replace all lamps in stage lighting fixtures, which are observed to be noticeably dimmed, as judged by the Architect or his representative

END OF SECTION 26 55 61

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SECTION 26 55 62
DRAMA LAB & CCTV STUDIO LIGHTING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Special Conditions and Division-1 Specification sections, apply to work specified in this section.

1.2 RELATED WORK AND REQUIREMENTS

A. Section 26 00 00

B. Definitions: For this project the following entities are referenced:

1. Owner: St. Lucie County School Board
2. Architect: Schenkel Shultz Architects
3. Theatre Consultant: TSG Design Solutions, Inc.

1.3 SCOPE

A. This section requires the fabrication, furnishing, delivery, installation and testing of the lighting system as indicated on the drawings and specified herein.

B. The contractor shall provide all materials, equipment, labor, tools, scaffolds, and incidentals necessary to perform the scope of work.

C. It is the intention of these specifications that the contractor provides a professional quality, complete and properly operating system in every respect and detail.

D. The installation contractor shall examine the plans in detail to familiarize him with the scope of the work. Special attention shall be paid to reviewing all project electrical drawings, floor plans, conduit risers, and the like for locations and quantities of boxes and enclosures.

E. The contractor shall assume full responsibility for a complete operating installation, in the required location, in accordance with the contract documents.

F. Coordinate fully with the Division 26 Contractor.

1.4 WORK INCLUDED

A. Without restricting volume or generality of above “Scope,” work to be performed under this section shall include, but not be limited to, the furnishing and installation of the following:

1. Drama Lab & CCTV Studio

a. A DMX/RDM controlled system with 8 20A, 120volt relays. The design shall incorporate three overhead lighting battens in a lab classroom configuration. A distributed DMX 512 system with DMX receptacles that shall be located at each of the previously listed lighting positions. A console plugging station to connect a future stage lighting console. The classroom lab performance lighting system consist of an 8 circuit room controller, a wall mounted touch screen control interface to create/record lighting presets, a blue tooth interface to create, record & play back lighting presets with mobile devices (app download is required), a DMX scene controller to capture lighting presets and generate DMX/RDM signal, a wall mount DMX/RDM splitter to distribute DMX 512 to the above listed lighting positions, pipe mounted plugging boxes to distribute the relay circuits, a mix of LED lighting fixtures, cables and accessories. The system infrastructure will be DMX/RDM based.

2. CCTV Studio

B. The Contractor shall examine the plans in detail to familiarize himself with the scope of the work.

C. The Contractor shall provide the required manufacturers' shop drawings.

D. The Contractor shall provide all the necessary specialty equipment for the complete lighting and dimming system installation as specified herein and shown on the drawings.

E. The Contractor shall coordinate the system control wire conduit and device locations with the Division 26 Contractor.

F. The Contractor shall deliver to the job site, and coordinate the installation of, the specialty equipment with the Division 26 Contractor.

G. The Contractor shall provide, install and terminate all system control wires.

H. The Contractor shall provide and install all system control devices.

I. The Contractor shall uncrate, assemble, lamp, hang and aim all the stage lighting fixtures as shown on the drawings.

J. Provide all lighting network certification reports.

K. The Contractor shall provide for the system activation.

L. The Contractor shall provide the system manuals.

M. The Contractor shall provide videotaped training sessions.

N. The Contractor shall provide the system warranty.

O. It is the Contractor's responsibility to ensure that the system and all of the system components, fixtures, equipment, devices, wire, terminations, field assemblies (including custom assemblies), etc. pass all required inspections by the local authority having jurisdiction.

P. Procurement of all required permits.

1.5 WORK NOT INCLUDED

A. The following work, although in another section, has a significant impact on the scope of this work. The Contractor is responsible for the successful coordination of the following:

1. System conduit.
2. Installation and termination of Line supply.
3. Installation and termination of Load wire.
4. Dimmer rack installation.
5. Non-dim panel installation.
6. Distribution installation.

1.6 CONTRACTOR'S QUALIFICATIONS:

A. Only qualified contractors shall be used.

B. The work of this section will be contracted to a single firm, referred to as the contractor.

C. The contractor shall be a lighting system contractor who regularly engages in the furnishing, installation and servicing of systems of similar nature, size, scope and complexity to that contemplated by this specification. The contractor shall have done so for a period of not less than five years preceding the bid date.

D. The contractor shall have maintained for the five years preceding the bid date, a suitably staffed and equipped service organization which has continuously offered maintenance and repair services for systems of the nature, size, scope and complexity to that contemplated by this specification.

E. The contractor shall have on staff a factory trained field service agent, capable of system testing, commissioning and troubleshooting systems of the nature, size, scope and complexity to that contemplated by this specification.

F. The contractor shall have on staff a qualified and competent lighting designer / engineer capable of designing systems of the nature, size, scope and complexity to that contemplated by this specification.

G. The contractor shall maintain for the duration of this contract all required business and professional licenses and insurance.

H. The contractor shall demonstrate to the satisfaction of the owner, through submittals presented in accordance with the project timetable, that the contractor meets all the above qualifications. The minimum contractor qualification submittal shall include the following:

1. Statement of company history. Include a breakdown by percentage of gross sales of all business activities the contractor is involved in for each of the last 5 years (e.g., system installation = 30%, expendable sales = 40%, equipment rentals = 20%, design and other professional services = 10%, etc).
2. Previous experience: Furnish a list of four installations of the type and size contemplated by these specifications, currently in use as originally installed, in which a theatre / system consultant was involved, completed in the last 5 years and the following information regarding each installation:

a. Name and address of each installation facility.
b. Facility owner and telephone number.
c. Name, address, and phone number of a person regularly employed by the owner, who is familiar with the operation of the systems and who has no connection or business connections with the contractor except as the contractor shall fully disclose
d. Name, address, and phone number of the theatre / system consultant, along with the names of all the consultant's personnel directly involved.
e. System shop drawing – These will be returned if the contractor provides a call tag or return postage.
f. Owner's manual drawing – These will be returned if the contractor provides a call tag or return postage.
g. System as-built drawings drawing – These will be returned if the contractor provides a call tag or return postage.
h. List of contractors personal involved with each person's responsibility on the project.
i. Name, address and phone number of the general contractor, along with the names of all key GC personnel directly involved.
j. Name address and phone number of the electrical contractor, along with the names of all key EC personnel directly involved.

3. Statement of current company capabilities and ownership.
4. Key Personal: For each of the key personnel listed below; Include individual's name, title, and number of continuous years of service to contractor. Include a resume detailing industry experience, and role within organization (include only full-time/regular staff employees; not independent contractor, freelance, or temporary positions). List all industry certifications held, training courses attended, and continuing education credits, including dates of attendance.

    a. Project Manager
    b. Senior Technician
    c. Service Manage

5. Factory Trained Field Service Agent. Include individual's name and title. List all factory held certifications, training courses attended, and continuing education credits, including dates of attendance. Provide a list of recently commissioned systems, scope of project, and commissioning dates.
6. Lighting Designer / Engineer. Include individual's name and title. List current design credits with scope of project, and design completion dates.
7. Other Department Staff. Include size of staff and experience of each staff member.
8. Replacement and Spare Parts Inventory – Provide detailed list of primary replacement parts, components, and spares typically held in inventory.
9. Test Equipment and Physical Plant – Include an inventory of all test facility equipment owned and used regularly by the Service Department. Provide description of physical plant and space utilization.
10. Copies of all business and professional licenses and insurance certificates.

I. For the purposes of this contract, Dealers, Jobbers, and Sales Representatives SHALL NOT be considered as eligible participants.

J. Without prejudice to others, the following contractors are considered qualified and do not need to submit contractor's qualifications.

Candela Controls
711 Business Park Blvd., Suite 101
Winter Garden, FL 34787
(407) 654-2420
Contact: Bill Ellis

MainStage
8761 A Ely Rd.
Pensacola, FL 32514
850-434-2080
Contact: Dean Sternke

Miami Stagecraft/ S.E.A.L. a Solotek company
12250 NE 13th Ct.
North Miami, FL 33161
(305) 891-1000
Contact: Steve Welsh

Murphy Lighting Systems
5113 Forsyth Commerce Rd
Orlando, FL 32807
(407) 895-7475
Contact: Chris Murphy

1.

PART 2 - PRODUCTS

2.1 GENERAL

A. When this document lists several acceptable manufacturers for a particular item of equipment, more than one of which is to be provided, the Contractor shall furnish all of those similar items of equipment from one manufacturer.

B. All dimmer racks, dimmer modules, lighting controls and lighting consoles shall be from the same manufacturer.

C. Any item of equipment or hardware that may not be specifically shown on the drawings or specified herein, but required for proper system operation or installation, shall be furnished and installed and be of the highest quality available.

D. All materials and equipment used in this project shall be new, unused and of the latest models and design. Refurbished materials and equipment are not permitted except where noted.

E. The performance of all equipment must meet the most recently published manufacture's data sheet.

F. UL Labels: All equipment, where applicable standards have been established, shall be listed by Underwriters' Laboratories, Inc., and shall bear an UL label when delivered to the job.

G. If so required by the local authority having jurisdiction, anything not arriving at the job bearing a UL label shall be field inspected and labeled by a nationally recognized testing laboratory recognized and approved by the local authority having jurisdiction.

2.2 ACCEPTABLE MANUFACTURERS

A. The stage lighting and control manufacturer shall be one who has been continuously engaged in the manufacture of stage lighting control equipment, wiring devices, and electronic dimmers for ten years or more.

B. Except where otherwise noted in this specification, the following are the approved manufacturers for the listed respective products:

Altman Lighting Inc.
57 Alexander Street
Yonkers, NY 10701
(914) 476-7987

Canto USA.
1092 West Atlanta Street SW
Suite300
Marietta, GA 30060
(888) 252-5912

Chauvet Professional
5200 NW 108th St.
Sunrise, FL 33351
(954) 577-4455

Elation Professional.
6122 S. Eastern Ave.
Los Angeles, CA 90040
(866) 245-7626

Electronic Theatre Controls, Inc.
3030 Laura Lane
Middleton, Wisconsin 53562
(800) 688-4116

LEX Products Corp.
401 Shippan Avenue
Stamford, CT 06902
(800) 643-4460

LynTec
8401 Melrose
Lenexa, KA 66214

(913) 529-2233

Lycian Stage Lighting
PO Box D
Kings Hwy
Sugar Loaf, NY 10981-0214
(845) 469-2285

Middle Atlantic Products, Inc.
North Corporate Drive
Riverdale, NJ 07457
(973) 839-1011

Pathway Connectivity
Acuity Brands Lighting
#103- 143917th Ave SE
Calgary AB T2G1J9, Canada
403-243-8110

Robert Juliat USA
48 Capital Dr.
Wallingford, CT 06492
(203) 294-0481

SSRC
11 Freedom Court
Greer, South Carolina 29650
(864) 848-9770

Vari-Lite/Strand
10911 Petal St.
Dallas, TX 75238
214-647-7880

C. Alternatives: In no case will equipment or materials of lesser design or workmanship be acceptable. Only those materials and equipment listed in this specification will be considered unless prior approval is sought and received.

1. Substitutions: When a specific piece of equipment specified has been discontinued and/or replaced by a new model, substitution will be acceptable when:

   a. Submission of complete data on the new model or substitute has been approved by the owner prior to equipment acquisition.
   b. Substitute equipment or the replacement of rejected equipment shall be at the sole expense of the contractor.

2. Substitutes shall be considered only when they are submitted fourteen days prior to bid date, and are accompanied by sufficient catalog data, specifications, and technical information for evaluation.

   a. Summarize proposal with a list of equipment catalog or series numbers. Substitute bids shall include a system riser diagram detailing component and any deviation of functionality from the drawings and specifications herein.

b. The bidder shall include the name, address, and phone number of at least two- (2) factory authorized Field Warranty centers within a 250-mile radius of the job site as a part of the submittal documents.

c. On the lighting fixtures, the bidder submitting other equipment shall include performance data taken and reported in compliance with the "Recommended Practice for Reporting Photometric Performance of Incandescent Filament Lighting Units used in Theatre and Television Production," approved as the official standard by the U.S. Institute for Theatre Technology, the Illuminating Engineering Society, the Society of Motion Picture and Television Engineers, and the American Theatre Association. For purposes of establishing the validity of such submissions, the manufacturer shall furnish this data from an independent testing laboratory. Proposals that fail to meet this requirement shall not be considered.

d. On the dimming system, the bidder submitting other equipment shall include pertinent performance data, charts and drawings showing in what respect the system will function in accordance with specification, and in what way it will deviate from the specification. This submittal shall include, but not be limited to the following:

   1) Rated ampacity, peak single cycle surge current rating, I^2t rating, and transient voltage rating of the output devices employed in the dimmers.
   2) Laboratory verification of minimum current rise time at a 90-degree conductive angle, with the dimmer operating at the maximum load.
   3) Description of the air-cooling and air filtration systems.
   4) Description of the packaging and ease of replacement for all spare parts required in this specification.
   5) Original Manufacturer's catalog data sheets for all major components of the dimmer system.

e. On the control system, the bidder shall submit the name of the manufacturer, and list of ten (10) or more operating systems in the State of Florida of the type specified which meet the performance control functions designed, with contact names and telephone numbers for references. This information shall be mandatory as a basis for determining the bidder's intent in meeting the full requirements of this specification and shall be submitted at least fourteen days in advance of bidding.

f. It is understood that any additions or revisions of wiring required by using substitute equipment, whether such wiring is part of this contract or of the prime electrical contract, shall be the responsibility of the bidder making the substitution.

g. If required by the Owner, the Consultant, or Architect, the bidder shall provide working samples of substitute equipment including lamps for any lighting fixtures, to be delivered to the premises designated for examination by Architects, Consultants, and such representatives as the Owner may direct. Handling, shipping and delivery to, or removal from site, of any sample required shall be at the cost of the Contractor. The Contractor shall be responsible for the arrangement of the cost of the electrical supply required to properly test any lighting instruments or item of equipment. Proposals which fail to address specification requirements or review comments will be rejected.

h. Prior approval submittal review and approval shall not be considered to be shop drawing review. Prior approval in no way relieves the Contractor of responsibility to fully meet the requirements and intent of this specification.

i. Should the contractor propose and receive approval for the use of alternative or substitute equipment which requires additional or modified conduit, the contractor will be solely responsible for the installation of such conduit.

2.3 DRAMA LAB LIGHTING SYSTEM

A. The room control system consists of a wall mount device that shall provide power for LED lighting fixtures, a wall mount touch screen controller that supports DMX/RDM protocol, a DMX scene controller, a blue tooth wireless access point and a DMX 512 splitter for DMX distribution to LED fixture locations. The room controller shall have eight output 20A 120 Volt relays for use with general purpose, tungsten and LED loads.

B. ETC is the basis of design ETC is the basis for design, acceptable manufacturers are Vari-Lite Strand or an approved equal.

1. Electronic Theatre Controls, Inc.

CAT. #	DESCRIPTION
ERMC8-TC-G2	Stage lighting room controller with Time clock option eight output 20A 120 Volt relays for use with general purpose, tungsten and LED loads.
ETS – Echo Touch Screen Controller	7” touch screen, 80 control channels, 64 presets & 4 sequences, supports DMX 512 protocol, RDM discovery of devices, Power 24VAC, color by architect from standard options.
ETS-LC	Touch Screen Locking Cover
EACC – Echo Access Interface	Provides communication from mobile app via Bluetooth, mobile app available for android & iOS devices, controls presets, zones & color
EDMXC- Echo DMX Scene Controller	e-Din rail mount, DMX input for snapshot capture of up to 32 lighting presets, supports sequence playback of presets.
CAT. #	DESCRIPTION
ERMC8-TC-G2	Stage lighting room controller with Time clock option eight output 20A 120 Volt relays for use with general purpose, tungsten and LED loads.

2.4 DRAMA LAB LIGHTING CONTROL CONNECTION PLATES

A. The system will be accessible via interconnection plates for the lighting control console and Ethernet/DMX 512 output receptacles located at the performance lighting positions. Furnish console plug in stations and lighting plugging stations; see contract drawings for type, quantities and locations.

2.5 DRAMA LAB DMX/RDM SPLITTER:

A. General:

1. The eDIN DMX/RDM Installation Repeater shall be a factory-assembled, pre-wired, contractor-ready wall mounted panel.
2. The Installation Repeater shall permit star-wiring of DMX512 and RDM lighting control data signals and shall isolate and protect DMX transmitters and DMX receivers from high common mode voltages, ground loop currents and other potentially damaging electrical faults.
3. The Installation Repeater shall have one (two, three) input port(s) and four (eight, twelve) output ports. All ports shall be bi-directional.
4. There shall be no in-line processing of the input signal to ensure that the output signals are all exact duplicates of the input signal.
5. DMX and RDM signal isolating/splitting shall be accomplished using standard 4-way DIN-rail mounted modules (Pathway Model #1009) for easy expansion and/or servicing.
6. The system shall be capable of repeating and distributing simplex protocols other than DMX512, provided they meet the electrical requirements of EIA-RS422 or RS485.

B. Features

1. Each 4-way DMX/RDM repeater module shall incorporate LED indicators for DC power input, CPU status, isolated DC power, DMX input, and output data for each port.
2. Each module shall be capable of regenerating four (4) exact duplicate data streams from the original source input data stream.
3. Each regenerated data stream shall have the same characteristics and capabilities as the input data stream.
4. It shall be possible to daisy-chain all modules on the same DMX universe or connect separate universes to each module.
5. One (1) DMX/RDM pass-thru port shall be provided on each repeater module. The pass-thru port shall be active, i.e., electrically repeated. If RDM Up to four (4) DMX/RDM repeater modules may be cascaded together using their pass-thru ports.
6. In DMX-only installations, up to eight (8) modules may be cascaded (daisy-chained) on the same DMX input data line using the pass-thru port or any output port.
7. Each output shall be capable of driving up to 32 DMX-only receiving devices over a maximum 500-meter (1600-ft.) length of cable.
8. Each output shall be capable of driving up to 31 DMX/RDM responding devices over a maximum 300-meter (1000-ft.) length of cable.
9. Each repeater module shall act as an RDM responder.
10. It shall be possible to field-update each module’s firmware via the DMX input port.

C. Electrical

1. The power supply shall be a DIN-rail mounted, field-replaceable, wide-range input (115/240VAC, 50/60 Hz), UL-listed switching power supply, sized according to the maximum number of modules the cabinet can accommodate.
2. There shall be 2500-volt electrical isolation between input and output sections of the supply.
3. All DMX input and output ports shall be capable of withstanding short-term application of up to 250V without damage to internal components.
4. Port protection shall be of the self-healing type, rated for 250V. Replaceable fuses shall not be acceptable.

5. The DMX input port shall provide 1500-volt optical isolation between the input signal wiring and output signal wiring.
6. DMX/RDM output ports shall be fully optically isolated from each other and floating with respect to earth ground.
7. 3DMX outputs shall provide self-healing protection against ground loops between adjacent ports.

D. The 4-Way DMX/RDM Installation Repeater basis of design is Pathway eDIN model #4813 or an approved equal.

2.6 DRAMA LAB LIGHTING FIXTURES

A. All LED lighting fixtures are to include a C-clamp, a safety cable w/spring clip, a male L5-20 twist lock to instrument power cable (plug type for power input at instrument is determined by manufacturer), a 10' power thru jumper cable and a 10' DMX male 5 pin to female DMX 5 pin thru jumper cable.

B. All fixtures of a similar type shall be from the same manufacturer (e.g., All ellipsoidal type fixtures, all fixed LED wash fixtures) unless noted otherwise.

C. Furnish and install the following theatrical lighting fixtures in the auditorium: see light plot for quantities.

QTY.	CAT. #	DESCRIPTION
	Electronic Theatre Controls, Inc. Cat. # CS PAR BLACK - ORGINAL OR Acceptable manufacturers are Vari-Lite Strand, Elation Professional, Chauvet Professional	ColorSource Par fixture with barn door, color frame, round narrow lens (32deg), round medium lens (50deg)
	Electronic Theatre Controls, Inc. Cat. # CSSPOTJRDB – BLACK 25-50 DEG OR Acceptable manufacturers are Vari-Lite Strand, Elation Professional, Chauvet Professional	ColorSource 25-50 Manual ZOOM led FIXTURE Deep Blue deg spot fixture with color frame,

2.7 DRAMA LAB LIGHTING PLUGGING BOXES

A. Pipe Mount Outlet boxes are fabricated from 16-gauge steel with a fine-texture, scratch-resistant, powder-coat finish. Outlets are 3-pole grounding of 20A grounded flush mount Edison female connectors for 120V relay circuits, Circuits are individually indicated with ¾" white die cut adhesive labels. Boxes are equipped with ground lugs. All faceplates match outlet box enclosure dimensions with no sharp edges exposed. Basis of design is ETC alternative manufacturers are SSRC, LEX or an approved equal.

B. Furnish the plugging boxes for relay lighting circuits; see distribution detail drawing for circuit designations and quantities and see device location drawing for locations

2.8 DRAMA LAB LIGHTING ACCESSORIES

A. Furnish the following stage lighting accessories for the Drama lab.

B. Lex Stage cable is the basis of design or an approved equal.

C. Provide all type S Edison jumpers and twofers required to cable the light plot and furnish the following jumpers. All jumpers are to have color coded length labeling at both ends of the cable.

1. 3 @ 5'-0", 12 AWG, type S extension cables w/male and female Edison connectors installed.
2. 3 @ 10'-0", 12 AWG, type S extension cables w/male and female Edison connectors installed.
3. 3 @ 25' -0", 12 AWG, type S extension cables w/male and female Edison connectors installed.
4. 1 @ 50' -0", 12 AWG, type S extension cables w/male and female Edison connectors installed.
5. 5 @ 2-Fers, Lex Products two-fer with w/male and female Edison connectors

D. Provide all 5 pin DMX jumpers required to cable the light plot and furnish the following jumpers. All jumpers are to have color coded length labeling at both ends of the cable.

1. (5) 5-Pin Male to 5-Pin Female XLR DMX Cable @ 5 foot
2. (5) 5-Pin Male to 5-Pin Female XLR DMX Cable @ 10 foot
3. (2) 5-Pin Male to 5-Pin Female XLR DMX Cable @ 25 foot

4. Four (4) Pattern Holders for ellipsoidal spotlights.
5. Patterns as follows:

a. Rosco #77805 M (OD 66mm, ID48mm), up to 2.03mm thick

2.9 CCTV STUDIO LIGHTING SYSTEM

A. The room control system consists of a wall mount device that shall provide power for LED lighting fixtures, a wall mount touch screen controller that supports DMX/RDM protocol, a DMX scene controller, a blue tooth wireless access point and a DMX 512 splitter for DMX distribution to LED fixture locations. The room controller shall have eight output 20A 120 Volt relays for use with general purpose, tungsten and LED loads.

B. ETC is the basis of design ETC is the basis for design, acceptable manufacturers are Vari-Lite Strand or an approved equal.

1. Electronic Theatre Controls, Inc.

CAT. #	DESCRIPTION
ERMC8-TC-G2	Stage lighting room controller with Time clock option eight output 20A 120 Volt relays for use with general purpose, tungsten and LED loads.
ETS – Echo Touch Screen	7” touch screen, 80 control

Controller	channels, 64 presets & 4 sequences, supports DMX 512 protocol, RDM discovery of devices, Power 24VAC, color by architect from standard options.
ETS-LC	Touch Screen Locking Cover
EACC – Echo Access Interface	Provides communication from mobile app via Bluetooth, mobile app available for android & iOS devices, controls presets, zones & color
EDMXC- Echo DMX Scene Controller	e-Din rail mount, DMX input for snapshot capture of up to 32 lighting presets, supports sequence playback of presets.
CAT. #	DESCRIPTION
ERMC8-TC-G2	Stage lighting room controller with Time clock option eight output 20A 120 Volt relays for use with general purpose, tungsten and LED loads.

2.10 CCTV STUDIO LIGHTING CONTROL CONNECTION PLATES

A. The system will be accessible via interconnection plates for the lighting control console and Ethernet/DMX 512 output receptacles located at the performance lighting positions. Furnish console plug in stations and lighting plugging stations; see contract drawings for type, quantities and locations.

2.11 CCTV STUDIO DMX/RDM SPLITTER:

A. General:

1. The eDIN DMX/RDM Installation Repeater shall be a factory-assembled, pre-wired, contractor-ready wall mounted panel.
2. The Installation Repeater shall permit star-wiring of DMX512 and RDM lighting control data signals and shall isolate and protect DMX transmitters and DMX receivers from high common mode voltages, ground loop currents and other potentially damaging electrical faults.
3. The Installation Repeater shall have one (two, three) input port(s) and four (eight, twelve) output ports. All ports shall be bi-directional.
4. There shall be no in-line processing of the input signal to ensure that the output signals are all exact duplicates of the input signal.
5. DMX and RDM signal isolating/splitting shall be accomplished using standard 4-way DIN-rail mounted modules (Pathway Model #1009) for easy expansion and/or servicing.
6. The system shall be capable of repeating and distributing simplex protocols other than DMX512, provided they meet the electrical requirements of EIA-RS422 or RS485.

B. Features

1. Each 4-way DMX/RDM repeater module shall incorporate LED indicators for DC power input, CPU status, isolated DC power, DMX input, and output data for each port.
2. Each module shall be capable of regenerating four (4) exact duplicate data streams from the original source input data stream.
3. Each regenerated data stream shall have the same characteristics and capabilities as the input data stream.
4. It shall be possible to daisy-chain all modules on the same DMX universe or connect separate universes to each module.
5. One (1) DMX/RDM pass-thru port shall be provided on each repeater module. The pass-thru port shall be active, i.e., electrically repeated. If RDM Up to four (4) DMX/RDM repeater modules may be cascaded together using their pass-thru ports.
6. In DMX-only installations, up to eight (8) modules may be cascaded (daisy-chained) on the same DMX input data line using the pass-thru port or any output port.
7. Each output shall be capable of driving up to 32 DMX-only receiving devices over a maximum 500-meter (1600-ft.) length of cable.
8. Each output shall be capable of driving up to 31 DMX/RDM responding devices over a maximum 300-meter (1000-ft.) length of cable.
9. Each repeater module shall act as an RDM responder.
10. It shall be possible to field-update each module's firmware via the DMX input port.

C. Electrical

1. The power supply shall be a DIN-rail mounted, field-replaceable, wide-range input (115/240VAC, 50/60 Hz), UL-listed switching power supply, sized according to the maximum number of modules the cabinet can accommodate.
2. There shall be 2500-volt electrical isolation between input and output sections of the supply.
3. All DMX input and output ports shall be capable of withstanding short-term application of up to 250V without damage to internal components.
4. Port protection shall be of the self-healing type, rated for 250V. Replaceable fuses shall not be acceptable.
5. The DMX input port shall provide 1500-volt optical isolation between the input signal wiring and output signal wiring.
6. DMX/RDM output ports shall be fully optically isolated from each other and floating with respect to earth ground.
7. 3DMX outputs shall provide self-healing protection against ground loops between adjacent ports.

D. The 4-Way DMX/RDM Installation Repeater basis of design is Pathway eDIN model #4813 or an approved equal

2.12 CCTV STUDIO LIGHTING FIXTURES

A. All LED lighting fixtures are to include a C-clamp, a safety cable w/spring clip, a male L5-20 twist lock to instrument power cable (plug type for power input at instrument is determined by manufacturer), a 10' power thru jumper cable and a 10' DMX male 5 pin to female DMX 5 pin thru jumper cable.

B. Furnish, install and cable the LED lighting fixtures and lighting equipment as shown and described on the CCTV Studio light plot.

2.13 CCTV STUDIO LIGHTING PLUGGING BOXES

A. Pipe Mount Outlet boxes are fabricated from 16-gauge steel with a fine-texture, scratch-resistant, powder-coat finish. Outlets are 3-pole grounding of 20A grounded flush mount Edison female connectors for 120V relay circuits, Circuits are individually indicated with ¾" white die cut adhesive labels. Boxes are equipped with ground lugs. All faceplates match outlet box enclosure dimensions with no sharp edges exposed. Basis of design is ETC alternative manufacturers are SSRC, LEX or an approved equal.

B. Furnish the plugging boxes for relay lighting circuits; see distribution detail drawing for circuit designations and quantities and see device location drawing for locations

2.14 CCTV STUDIO LIGHTING ACCESSORIES

A. Furnish the following stage lighting accessories for the CCTV Studio.

B. Lex Stage cable is the basis of design or an approved equal.

C. Provide all type S Edison jumpers and twofers required to cable the light plot and furnish the following jumpers. All jumpers are to have color coded length labeling at both ends of the cable.

1. 3 @ 10'-0", 12 AWG, type S extension cables w/male and female Edison connectors installed.
2. 3 @ 25' -0", 12 AWG, type S extension cables w/male and female Edison connectors installed.
3. 2 @ 50' -0", 12 AWG, type S extension cables w/male and female Edison connectors installed.
4. 5 @ 2-Fers, Lex Products two-fer with w/male and female Edison connectors

D. Provide all 5 pin DMX jumpers required to cable the light plot and furnish the following jumpers. All jumpers are to have color coded length labeling at both ends of the cable.

1. (5) 5-Pin Male to 5-Pin Female XLR DMX Cable @ 5 foot
2. (5) 5-Pin Male to 5-Pin Female XLR DMX Cable @ 10 foot
3. (5) 5-Pin Male to 5-Pin Female XLR DMX Cable @ 25 foot

PART 3 - EXECUTION

3.1 STANDARDS COMPLIANCE

A. Comply with all local building codes.

B. In the absence of specific local codes, comply with the National Electrical Code (NFPA-70) as applicable to installation and construction of stage lighting and control equipment.

C. Where not in conflict with local building codes or the National Electrical Code comply with industry standard professional practices.

D. Installation practices shall be in accordance with OSHA Safety and Health Standards.

3.2 SHOP DRAWINGS

A. Submit within thirty (30) days of the bid acceptance, for review and approval by the Owner, Architect, and Consultant:

B. Complete shop drawings and data sheets for all items specified.

C. Complete shop drawings for all components, assemblies, sub-assemblies, cabinets, wiring devices and hardware required to implement the work.

D. Riser diagrams showing all quantities, types and sizes of inter-connection wires to be installed by others.

E. Schematics of all block assemblies and sub-assemblies, including pin out identification of all low voltage cable connectors.

F. Approval of shop drawings does not relieve the Contractor of the responsibility of providing equipment in accordance with these specifications. Any deviations from the specifications shall be "starred" and noted in 1/4" high letters. Only deviations which improve the quality of the equipment shall be considered.

G. In addition to drawings, the Contractor may elect to submit catalog cuts for certain standard equipment items. These shall contain full information on dimensions, construction, applications, etc. to permit proper evaluation. In addition, they shall be properly identified as to their intended use and any options or variations shall be clearly noted.

H. Samples may be requested by the Architect and shall be furnished for inspection at the Architect's office, at the Contractor's sole expense.

I. Prior to the commencement of fabrication and delivery, the Contractor shall submit for approval, to the Architect, an outline of a proposed commencement and completion schedule of project requirements.

3.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver stage lighting equipment and controls to job site securely wrapped in containers.

B. Coordinate delivery dates with the Division 26 contractor

C. All equipment shall be stored in a clean, dry space.

D. Discrepancies in quantities or missing equipment shall be noted, in writing, and brought to the attention of the manufacturer within five days of receipt.

E. Replacement of missing or damaged equipment shall be the responsibility of the Contractor.

F. Handle equipment and controls carefully to prevent breakage, denting and scoring finish.

G. Replace and return damaged units to the equipment manufacturer immediately.

H. Store in original cartons and protect from dirt, physical damage, weather, and construction traffic.

3.4 INSTALLATION

A. The Contractor shall furnish, deliver, install and terminate all system control wires.

1. All cables shall be permanently labeled at every termination. The label shall not be handwritten. Clear heat shrink shall cover the label.
2. Service loops of not less than 6" will be present at all terminations to equipment.
3. All pulls to be made by hand, care will be taken not to nick cable jackets, and any nicked or damaged cable will be replaced.
4. A pull string will be left in all conduits after wire is installed.
5. NO SPLICES WHATSOEVER IN CONDUIT!
6. Include spare cables with all field runs. Quantity to be 10% or 1 whichever is greater unless otherwise specified.
7. Where shielded cable is in use leave shield drain wire the same length as the circuit conductor(s), sleeve shield drain wire in green PVC tubing. Cap where the cable jacket was removed with heat shrink. Where the shield drain wire is to be lifted follow the above and fold back over cable jacket. Then cap end with heat shrink. Do not use a single piece of heat shrink for this use two smaller ones.
8. All soldering will be clean and neat and not exhibit evidence of a " cold" joint, were necessary heat sinks will be used. Use only rosin core "electronic type" solder.
9. Wire nuts will be not allowed.

B. The Contractor shall furnish and install all system control devices.

C. The Contractor shall hang and aim the stage fixture hanging plot.

1. Provide the Theatre Consultant fourteen (14) days' notice prior to this work being scheduled.
2. The Theatre Consultant shall verify the aiming of the stage fixtures.

D. The installation of all work shall be neat.

E. All boxes, equipment, etc. shall be plumb and square.

F. The installation shall conform to the plans and specs.

G. The contractor shall not commence the installation of equipment and devices, other than the pulling of cable, until all areas are clean, painted and finished to a point that they are completely dust, dirt, lint, fiber and airborne particle free. The air conditioning system must be operating to its design level and be able to keep all areas with control equipment stable.

3.5 INSTALLATION COORDINATION

A. The Contractor shall specifically coordinate the placement and sizes of conduit relating to this work and shall specifically review and approve the conduit rough-in in time to advise all parties of needed changes, omissions, etc.

B. The Contractor shall report this successful coordination in writing to the Architect.

C. If any conflicts or omissions occur as a result of the Contractor's unsuccessful coordination of the above-mentioned work, it shall be the Contractor's responsibility to correct, furnish and install any additional material that may be required.

D. The contractor shall at all times coordinate his work with the other trades to ensure smooth progress of work and satisfactory final results.

E. The Contractor shall examine areas and conditions under which stage lighting and controls are to be installed and notify the Architect in writing of conditions detrimental to proper installation and operation.

3.6 INSPECTION AND TESTING:

A. During the installation of the equipment the contractor shall arrange for access as necessary for inspection of equipment by the owner's and/or architect's representatives.

B. Provide a safe means of accessing all system components for all visits.

C. Equipment Pretesting: All racks are to be built and wired in the contractors' shop and tested prior to delivery to site. All other equipment is to be tested prior to delivery and installation. A written test report will be submitted to the owner.

D. Final Inspection:

1. The final inspection will confirm that the systems, as installed, meet the requirements of this spec, the contract documents, and the approved contractor's shop drawing and submittals.
2. The contractor will inform the owner in writing of the system's completion. The contractor will then request final inspection by the consultant and carry out the necessary coordination. This coordination includes:

    a. Giving at least fourteen days' notice to the consultant prior to the final inspection.
    b. Arranging for the contractors and consultants exclusive use of the space.
    c. Arranging for a HVAC technician to be available to turn the AC system on and off as required.
    d. Arranging for a sound technician to be available to control the sound system as required.
    e. The contractor's job foreman and one additional worker familiar with the job will be present during all check out, testing and inspection.

3. Contractor will complete the following tasks prior to consultant's arrival:

    a. Unpack and assemble all portable equipment.

b. Place all portable equipment in one location.
c. If anything has been turned over to the owner have the signed Letters of Transmittal on site.
d. Complete all required paperwork (pre-testing reports, letters indicating successful coordination of the installation, etc.).
e. Provide all lighting network certification reports.
f. Remove all security covers.
g. Contractor will provide all necessary software, cables, and interfaces to facilitate the setting of computer controlled, remote controlled or digitally controlled equipment.

4. Contractor will provide the following test equipment for use during inspection and acceptance testing:

a. Some type of light meter
b. Some type of DMX checking device
c. Some type of Multi-meter.
d. The contractor will provide safe means to access all system components during the entire commissioning process.
e. The contractor shall provide personnel and equipment to make any adjustments to the theatrical lighting system(s), as well as to correct problems, for the entire inspection and testing period.

E. The Theatre Consultant or his representative will conduct all the final system tests in order to determine final acceptance.

F. In no event shall the theatrical lighting systems installation be submitted for final approval or acceptance until any and all elements of the facility that may have a bearing on the system performance, including but not limited to doors, windows, HVAC, carpeting, furniture, wall coverings, stage flooring, rigging systems, interior design elements, architectural lighting and lighting control systems have been completed and are operable. All elements that may affect stage lighting systems operation or performance shall be "on" and operating during adjustments. The stage lighting contractor will be responsible for coordinating the requirements of this paragraph with other work on the project.

G. Equipment Backorders. Should any component or equipment be on backorder at the time of system inspection and testing the contractor shall provide comparable loaner equipment at the contractor’s expense. Said equipment shall remain on-site until backordered equipment is delivered and installed.

3.7 MANUFACTURER’S SERVICES

A. The Contractor shall provide for:

1. A manufacturer’s field service engineer to perform initial system activation. Under no circumstances shall power be applied to any equipment prior to initial system activation.
2. The manufacturer’s field service engineer shall inspect and confirm that all low voltage terminations are correct.
3. Such engineering services shall be furnished within twenty-one (21) days of a written request by The Contractor.

3.8 TRAINING AND INSTRUCTION

A. The Contractor shall furnish eight (8) hours of onsite instruction to Owner designated persons. This instruction shall happen on two occasions. The general conditions require all training sessions to be videotaped. This contractor is to coordinate with this requirement and if required perform the taping.

1. The first occasion shall take place at the time of initial system activation and be performed by the manufacturer's field service engineer. The duration of this occasion shall be not less than three (3) hours. This instruction shall cover all aspects of operation and maintenance required by this system.
2. All other occasions shall be coordinated with the owner representative and Contractor with (21) days written notice. This instruction shall be an overall review of the system operation and detailed console operations. The finial occasion shall take place within the first six months following system activation.

B. Provide operational assistance for the first usage of the system. This is to be on the owner's time schedule but, not to exceed 8 hours.

3.9 MANUALS

A. Upon completion of the work, the Theater Equipment Contractor shall submit four detailed printed copies of Operations and Maintenance Manuals for each space, 2 for the Owner, and 1 for the Architect/Engineer of Record and one for Consultants. The Contractor shall also provide CD-ROMs with the Operations and Maintenance Manuals in PDF form with a hyper link table of contents, also any and all CAD drawings including as-built shop drawings, equipment descriptions, network certification certificate, any required certificates or warranties, and parts lists or other electronically produced submittal items.

B. The contractor shall also provide a USB flash drive for each space with all project documents including the initial configuration files for;

1. The control electronics modules for the stage lighting dimmers and house light dimmers,
2. The stage lighting consoles.
3. The stage lighting network switches and the portable network nodes.
4. All multi parameter stage lighting fixtures. Submit in quantities and file formats as required by the Architect

C. Additionally, inside the primary dimmer or auxiliary control rack, provide a document pouch and one set of final as-built drawings. Before distribution of manuals submit one copy to consultant for approval. Each manual is to contain the following:

1. System one-line drawings including all labeling and changes ("as builts ").
2. Owner's manual for each piece of equipment.
3. Schematic diagram for each piece of equipment.
4. Contractors service phone numbers in a conspicuous place.
5. All test reports.

3.10 WARRANTIES

A. Contractor will warrant the system to be free from defects in materials and workmanship for a period of one year from the date of acceptance, or first beneficial use, whichever comes first. Acts of god and owner abuse or neglect are not covered.

B. During the warranty period the contractor will respond to and correct any call for service within one day of the call.

C. Loaner equipment will be provided if necessary.

D. The manufacturer of the stage lighting and control equipment shall warranty the electrical distribution, dimming and control equipment to be free from defects of material or workmanship for a period of two years from the date of acceptance.

E. The manufacturer shall warranty all fixtures and accessories (except lamps) to be free from defects of material or workmanship for a period of one year from the date of acceptance. During the period of this warranty, equipment that proves to be defective shall be repaired or replaced at no charge (excluding freight). Unauthorized local repairs of equipment during the warranty period shall relieve the manufacturer of his responsibilities under this warranty.

F. Include the name, address, and phone number of at least two- (2) factory authorized Field Warranty centers within a 250-mile radius of the job site in the operation and maintenance manual.

3.11 FINAL ACCEPTANCE

A. The following conditions must be met before final acceptance will be granted:

B. Inventory of all equipment by the project Architects or his representative.

C. All inventoried portable equipment is in secure storage, accessible only by the Owner.

D. Approval of final tests and inspections by the project Architects, Theatre Consultant, and Owner.

E. Submittal to the Architect of three (3) signed copies of the warranty(ies).

F. Satisfactory completion of all punch list items.

G. At the date of system activation, the Contractor shall furnish and replace all lamps in stage lighting fixtures, which are observed to be noticeably dimmed, as judged by the Architect or his representative

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Division 27

Communications

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SECTION 27 00 00
COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of General Requirements/Provisions shall be considered a part of this section and shall have the same force as if printed herein full. In addition, all information related to communications infrastructure that is documented in the architectural, structural, mechanical, and electrical drawings/documents shall be included as part of the Communications documents.

B. Related Specifications:

1. Division 00
2. Division 01
    a. Section “Project Management and Coordination”
    b. Section “Submittal Procedures”
    c. Section “Product Requirements”
    d. Section “Closeout Procedures”
    e. Section “Warranties”
3. Division 07 Section "Firestopping"
4. Division 08 Section "Access Doors and Frames."
5. Division 09 Section "Interior Painting"
6. Division 26
    a. Section “Grounding and Bonding for Electrical Systems”
    b. Section “Raceways and Boxes for Electrical Systems”
    c. Section “Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits”
7. Division 27 all applicable Sections
8. Division 28 all Sections

E. Applicable requirements of the Division 26, 27 and 28 Design Criteria shall all be considered a part of this Division and shall have the same force as if written herein full.

1.3 QUALITY ASSURANCE

A. Specifications, Standards and Codes: All work shall be in accordance with the following:

1. The 2008 edition of the National Electrical Code (NFPA 70)

2. American National Standards Institute (ANSI)
3. National Electrical Manufacturers Association (NEMA)
4. Telecommunications Industries Association (TIA)
5. Electronic Industries Association (EIA)
6. Institute of Electrical & Electronics Engineers (IEEE)
7. Underwriters Laboratories (UL)
8. American Standards Association (ASA)
9. Building Industry Consulting Services International (BICSI)
10. Federal Communications Commission (FCC)
11. Occupational Safety and Health Administration (OSHA)
12. American Society of Testing Material (ASTM)
13. Americans with Disabilities Act (ADA)
14. Local city and county ordinances governing electrical work
15. In the event of conflicts, the more stringent provisions shall apply.

1.4 SCOPE

A. The work to be done under this section of the Specifications shall include the furnishing of labor, material, equipment and tools required for the complete installation of the work indicated on the Drawings or as specified herein.

B. All materials, obviously a part of the Communications Infrastructure and necessary to its proper operation, but not specifically mentioned or shown on the Drawings, shall be furnished and installed without additional charge.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the engineer shall be notified of the discrepancy.

1.5 WORK INCLUDED

A. The Communications Infrastructure installed and work performed under this Division of the Specifications shall include but not necessarily be limited to the following:

1. Voice/Data Cabling Infrastructure
2. CATV Cabling Infrastructure System
3. Audio-Visual Systems
4. Digital Signage and Wayfinding
5. Overhead Sound System
6. Master clock system
7. Point of Sales systems
8. Communications conduits, raceways, cable tray, racks, cabinets and equipment mounting boards
9. Grounding and Bonding of Communications Equipment

1.6 DEFINITIONS

A. Terms: The following definitions of terms supplement those of the General Requirements and are applicable to Division 27 – Communications.

B. Provide: As used herein shall mean “furnish, install and test (if applicable) complete.”

C. Infrastructure: As used herein shall mean cable, conduit, raceway, cable tray or j-hooks with all required boxes, fittings, connectors, and accessories; completely installed.

D. Work: As used herein shall be understood to mean the materials completely installed, including the labor involved.

1.7 DRAWINGS

A. Drawings are generally diagrammatic and show the arrangement and location of pathways, outlets, support structures and equipment. The Contractor shall carefully investigate the structural and finish conditions affecting his work and arrange his work accordingly. Should conditions on the job make it necessary to make adjustments to pathways or materials, the Contractor shall so advise the Engineer and secure approval before proceeding with such work.

B. Where exact locations are required by equipment for stubbing-up and terminating conduit concealed in floor slabs, the Contractor shall request shop drawings, equipment location drawings, foundation drawings, and any other data required by him to locate the concealed conduit before the floor slab is poured.

C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

D. The right is reserved to make reasonable changes in locations of equipment indicated on Drawings prior to rough-in without increase in contract cost.

E. The Contractor shall not reduce the size or number of conduit runs indicated on the Drawings without the written approval of the Engineer.

F. Any work installed contrary to Contract Drawings shall be subject to change as directed by the Engineer, and no extra compensation will be allowed for making these changes.

G. The location of equipment, support structures, outlets, and similar devices shown on the Drawings are approximate only. Do not scale Drawings. Obtain layout dimensions for equipment from Architectural plans unless indicated on Communications plans.

H. Schematic diagrams shown on the Drawings indicate the required functions only. The technology of a particular manufacturer may be used to accomplish the functions indicated without exact adherence to the schematic Drawings shown. Additional labor and materials required for such deviations shall be furnished at the Contractor's expense.

I. Verify the ceiling type, ceiling suspension systems, and clearance above hung ceilings prior to ordering cabling and associated hardware. Notify the Engineer of any discrepancies.

J. Review all architectural drawings for modular furniture.

K. Portions of these Drawings and Specifications are abbreviated and may include incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as indicated on the Drawings,” “In accordance with,” “a,” “the” and “all are intended” shall be supplied by inference.

1.8 SUBMITTALS

A. Submit for approval, details of all materials, equipment and systems to be furnished. Work shall not proceed without the Owner and/or the Project Manager's approval of the submitted items. Four (4) copies of the following shall be submitted:

1. Submittals for individual systems and equipment assemblies that consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered, reviewed or stored, and such submittals will not be returned except at the request and expense of the Contractor.
2. Shop drawings shall include equipment racks, patch panels, termination blocks, connection details, rack mounting details and any other details not included in the construction drawings.

B. Any materials and equipment listed that are not in accordance with Specification requirements may be rejected.

C. The approval of material, equipment, systems and shop drawings is a general approval subject to the Drawings, Specifications and verification of all measurements at the job. Approval does not relieve the Contractor from the responsibility of shop drawing errors. The Contractor shall carefully check and correct all shop drawings prior to submission for approval.

1.9 QUALITY ASSURANCE

A. Equipment and materials required for installation under these Specifications shall be the current model and new (less than one [1] year from the date of manufacture), unused and without blemish or defect.

B. Equipment shall bear labels attesting to Underwriters Laboratories, where subject to label service. Manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacture of said equipment a minimum of three (3) years and, if so directed by the Owner, be able to furnish proof of their ability by submitting affidavits and descriptive data about their product including size and magnitude comparable to requirements specified herein.

1.10 CONTRACTOR QUALIFICATIONS

A. The Contractor shall have total responsibility for the coordination and installation of the work shown and described in the Drawings and Specifications. The Contractor shall be a company specializing in the design, fabrication and installation of integrated communications systems.

B. Communications Systems specified shall be installed under the direction of a qualified Contractor. Qualification requirements shall include submittal by the Contractor to the Architect of the following:

1. List of previous projects of this scope, size and nature; including names and sizes of projects, description of work, time of completion and names of contact persons for reference.
2. Shall certify that they are manufacturer-authorized for work to be performed.

C. Contractor must employ at least one (1) full-time Registered Communications Distribution Designer (RCDD). The RCDD shall be a W2 employee and not a subcontractor. The contractor shall also have a BICSI Certified Technician on site during installation.

1.11 COORDINATION WITH OTHER TRADES

A. The Contractor shall coordinate communications work with that of other sections as required ensuring that the entire communications work will be carried out in an orderly, complete and coordinated fashion.

1.12 SITE INVESTIGATION

A. Prior to submitting bids of the project, visit the site of the work to become aware of existing conditions that may affect the cost of the project. Where work under this project requires extension, relocation, reconnections or modifications to existing equipment or systems, the existing equipment or systems, shall be restored to their original condition before the completion of this project.

1.13 PERMITS

A. Obtain all permits and inspections for the installation of this work and pay all charges incident thereto. Deliver to the Owner all certificates of said inspection issued by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Where equipment is identified by manufacturer and catalog number, it shall be as the base of requirements for quality and performance. Where manufacturers for equipment are identified by name, the Contractor may submit for approval, similar equipment of other manufacturers as substitution. The Engineer's decision as to whether the submitted equipment is acceptable shall be final and binding.

B. All changes necessary to accommodate the substituted equipment shall be made at the Contractor's expense, and shall be as approved by the Engineer. Detailed drawings indicating the required changes shall be submitted for approval at the time the substitution is requested.

C. If substitutions are made in lieu of device specified; form, dimension, design and profile shall be submitted to the Engineer for approval.

D. Submit request for approval of substitute materials in writing to the Architect at least ten days prior to bid opening.

2.2 MATERIALS

A. All materials used in this work shall be new and shall bear the inspection label of Underwriters' Laboratories Inc. or certification by other recognized laboratory.

B. The published standards and requirements of the Telecommunications Industries Association (TIA), National Electrical Manufacturers Association (NEMA), the American National Standard Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), and the American Society of Testing Materials (ASTM), are made a part of these Specifications and shall apply wherever applicable.

C. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.

D. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer or partner manufacturers that offer a certified solution.

E. Components of an assembled unit need not be products of the same manufacturer, but must offer a certified end-to-end solution.

F. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

G. Components shall be compatible with each other and with the total assembly for the intended service.

H. The contractor shall be responsible for the delivery, receipt, and safe storage on site of all communications materials and equipment to the job site until the job is completed and the owner accepts the equipment or installation. Replace any damaged materials or equipment.

I. Records shall be kept of all materials and equipment delivered to the job site in the form of shipping manifests, bills of laden or signed receipts.

J. At the end of the installation all remaining communications materials and equipment will be inventoried and turned over to the owner.

PART 3 - EXECUTION

3.1 EXAMINATION OF CONDITIONS

A. Prior to the start of work, the Contractor shall carefully inspect the installed work of other trades and verify that such work is complete to the point where installation may properly commence. Start of work indicates acceptance of conditions.

B. Install equipment in accordance with applicable codes and regulations, the original design and the referenced standards.

C. In the event of a discrepancy, immediately notify the Project Manager and the General Contractor.

D. Do not proceed with installation until unsatisfactory conditions and discrepancies have been fully resolved.

3.2 PROTECTION OF SYSTEMS AND EQUIPMENT

A. Protect materials and equipment from damage during storage at the site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, theft, moisture, extreme temperature and rain.

B. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering the sides with securely fastened protective rigid or flexible waterproof coverings.

C. During installation, equipment shall be protected against entry of foreign matter on the inside and be vacuum cleaned both inside and outside before testing, operating or painting.

D. As determined by the Owner or Engineer, damaged equipment shall be fully repaired or shall be removed and replaced with new equipment to fully comply with requirements of the Contract Documents. Decision of the Owner or Engineer shall be final.

E. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with the same quality of paint and workmanship as used by the manufacturer.

3.3 ACCESS TO EQUIPMENT

A. Equipment shall be installed in location and manner that will allow convenient access for maintenance and inspection.

B. Working spaces shall be not less than specified in the National Electrical Code (NEC) for voltages specified.

C. Where the Project Manager determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled, one time only, as directed by the Project Manager, at no additional cost to the Owner. “Conveniently accessible” is defined as being capable of being reached without the use of ladders or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and duct work.

3.4 CLEANING

A. During construction, and prior to Owner acceptance of the building, remove from the premises and dispose of packing material and debris caused by communications work.

B. Remove dust and debris from interiors and exteriors of electrical equipment. Clean accessible current carrying elements prior to being energized.

3.5 COMPLETION

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and similar items. Leave the premises clean, neat and orderly.

B. Results Expected: Systems shall be complete and operational and controls shall be set and calibrated. Labeling, testing, start-up and cleaning work shall be complete.

C. Maintenance Materials: Special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered to the Owner.

3.6 TESTING AND VERIFICATION

A. See specific Division 27 sections for testing parameters of sub-systems.

B. The Contractor shall verify that requirements of this Specification are met. Verification shall be through a combination of analyses, inspections, demonstrations and tests, as described below.

C. Verification by inspection includes examination of items and comparison of pertinent characteristics against the qualitative or quantitative standard set forth in the Specifications. Inspection may require moving or partially disassembling the item to accomplish the verification, included as part of the work at no additional cost to the Owner.

D. The Contractor shall verify by formal demonstrations or tests that the requirements of this Specification have been met. The Contractor shall demonstrate that the communications systems, components and subsystems meet Specification requirements in the “as-installed” operating environment during the “System Operation Test.” Even though no formal environmental testing is required, the Contractor shall measure and record temperature, humidity and other environmental parameters and the environmental conditions, which were encountered during the “System Operation Test.”

E. The Contractor shall carefully plan and coordinate the final acceptance tests so that tests can be satisfactorily completed. The Contractor shall provide necessary instruments, labor and materials required for tests, including the equipment manufacturer's technical representative and qualified technicians in sufficient numbers to perform the tests within a reasonable time period.

F. The Contractor shall satisfy all items detailed in the final acceptance check-off list (punch list). The list shall be a complete representation of specified installation requirements. At the time of final acceptance punch list items shall be corrected until the system is found to be acceptable to the Owner and the Project Manager.

G. After the Contractor systems have been installed and tested, the completed test plan shall be signed by the Communications Contractor Project Manager and submitted for approval.

END OF SECTION 27 00 00

SECTION 27 05 00
COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Related Specifications:

1. Division 25
2. Division 26
3. Division 27
4. Division 28

1.2 SUMMARY

A. Section Includes:

1. Communications equipment coordination and installation.
2. Sleeves for pathways and cables.
3. Sleeve seals.
4. Grout.
5. Common communications installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of communications equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.

4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular pace between sleeve and pathway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide duct name or designation or comparable product by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

3. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.

4. Pressure Plates: Stainless steel. Include two for each sealing element.
5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 27 05 00

SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 26 – Electrical and Division, 27 – Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Grounding and Bonding for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.4 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Grounding Busbar Manufacturer(s):

1. Harger
2. B-Line
3. Chatsworth Products, Inc.

2.2 GROUNDING CONDUCTORS

A. Grounding Conductor:

1. Construction shall be Type THHN copper conductors, insulated with heat and moisture resistant PVC over which a UL listed jacket is applied.
2. Jacket color shall be green.

2.3 GROUNDING LUGS

A. Grounding Lugs and Hardware:

1. Grounding lugs shall be 2-hole and installed with a crimper that when properly executed the die of the crimper impresses the die # on the lug base. All lugs shall be sleeved with clear heat-shrink to allow for inspection of the crimp. Silicon bronze or stainless steel bolts and washers shall be used to install lugs to equipment. Exothermic welding is also allowed.

2.4 GROUNDING BUSBARS

A. Grounding Busbar:

1. The grounding busbar shall be made of 1/4" thick solid copper.
2. The grounding busbar shall be installed with minimum clearance, 1" offsets and 1-1/2" insulators.
3. The grounding busbar shall accommodate 2-hole compression lugs.
4. The grounding busbar shall meet or exceed ANSI/TIA-607-B requirements.

PART 3 - EXECUTION

3.1 GROUNDING

A. The facility shall be equipped with a Communications Bonding Backbone (TBB). This backbone shall be used to ground all communications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA-607-B Telecommunications Bonding and Ground Standard.

B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding busbar (TMGB). Each telecommunications room (TR) shall be provided with a telecommunications ground busbar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility.

C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the MC/IC/TC shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression lugs.

D. All wires used for communications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap or green tape. All cables and busbars shall be identified and labeled in accordance with the ANSI/TIA-606-A.

3.2 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 05 26

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SECTION 27 05 28
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 26 – Electrical and Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Pathways for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.4 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Cable Tray System Manufacturer(s):

1. Chatsworth
2. Cablofil
3. Flex Tray
4. Copper B-Line

B. Approved Cable Hanger Manufacturer(s):

1. Erico Products – Caddy
2. Panduit
3. Or Approved Equal

C. Approved Tie Wrap/Velcro Strap Manufacturer(s):

1. Thomas & Betts
2. Panduit
3. Or Approved Equal

2.2 CONDUIT

A. Rigid and Intermediate (RGI) Conduit:

1. Rigid conduit, intermediate conduit, couplings, locknuts, bushings, elbows and connectors shall be standard thread. All materials shall be steel. Set screw or non-threaded fittings are not permitted.

B. Non-Metallic (PVC) Conduit:

1. Non-metallic conduit shall be heavy wall, Schedule 80 PVC.
2. Couplings and connectors for non-metallic conduit shall be of the same material and be the product of the same manufacturer of the conduit furnished.

C. Electrical Metallic Tubing (EMT):

1. Electrical metallic tubing (EMT), couplings and connectors shall be steel. Malleable iron, pressure-cast or die-cast fittings are not permitted.
2. All connectors shall be compression type.

D. Conduit Support:

1. Individual conduit hangers shall be galvanized spring steel specifically designed for the purpose and sized appropriately for the conduit type and diameter. Support individual conduits 1-1/2 inch and smaller with 1/4 inch threaded steel rods and use 3/8 inch rods for 2 inch and larger.
2. Conduit support channels shall be 14 gauge galvanized (or equivalent treatment) channel sized for the amount of conduit to be supported. Channel suspension shall be 3/8" threaded steel rods. Attach suspension rods to structure with swivel type connectors. Conduit straps shall be spring steel type compatible with channel.
3. Conduit straps shall be single hole cast metal type or two hole galvanized metal type. Conduit clamps shall be spring steel type for use with exposed structural steel.

E. Innerduct / Inner-Conduit Channel:

1. Innerduct shall be corrugated plastic equipped with pull-string or mule tape.
2. Inner-conduit channel (MaxCell) shall be 3-channel with each channel equipped with mule tape.
3. See Drawings for innerduct / inner-conduit channel (MaxCell) details.

2.3 METALLIC COMMUNICATIONS OUTLET BOXES

A. Metallic outlet boxes and device covers shall be galvanized steel not less than 1/16" thick.

B. The dimensions of the metallic outlet box shall be 4" x 4" square with a minimum depth of 2-1/8".

C. Metallic outlet boxes shall be equipped with single device covers (or two-device covers where needed). Where installed in plaster, gypsum board, etc., covers shall be raised to compensate for the thickness of the wall finish.

D. Where metallic outlet boxes are to be empty for future use, blank coverplates shall be used.

2.4 NON-METALLIC COMMUNICATIONS OUTLET BOXES

A. The non-metallic outlet box shall be thermoplastic and be rated according to the space it occupies.

B. The dimensions of the non-metallic outlet box shall be approximately 4" x 4" square with a minimum depth of 2-1/8".

C. Non-metallic outlet boxes shall be equipped with single device covers. Covers shall be raised to compensate for the thickness of the wall finish.

D. Where non-metallic outlet boxes are to be empty for future use, blank faceplates shall be used.

2.5 PULL BOXES

A. Pull boxes shall be constructed of galvanized steel with flat, removable covers fastened with plated steel screws.

B. Pull boxes shall be equipped with keyhole screw slots in the cover to permit removal of the cover without extracting the screws.

C. Pull boxes shall have provisions for grounding.

2.6 CABLE TRAY

A. Cable Tray System:

1. Cable tray shall be steel or aluminum construction.
2. Cable tray cross members shall be factory welded at 9" intervals maximum.
3. Cable tray shall be equipped with two (2) support rails that run the length of each segment.
4. End caps shall be installed on the exposed ends of the cable tray, channel supports and bolts. Protective covers shall be installed on threaded rods that come in contact with cabling plant.
5. Wall mount cable tray used in limited clearance areas shall be hook style and constructed of aluminum.

6. See Drawings for cable tray dimensions.

    a. Cable Tray color shall be black.

2.7 CABLE HANGERS

A. J-Hooks:

1. J-hooks shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables. J-hook shall be UL Listed.
2. J-hooks shall have flared edges to prevent damage while installing cables.
3. J-hooks sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
4. Amount of cables shall not exceed capacity. Install per manufacturer's specifications.

B. Adjustable Non-Continuous Cable Support Sling:

1. Constructed from steel and woven laminate; sling length can be adjusted to hold up to 425 4-pair balanced twisted pair cables; rated for indoor use in non-corrosive environments. Rated to support Category 5 and higher cable, or optical fiber cable. Cable support sling shall be UL Listed.
2. Adjustable non-continuous cable support sling shall have a static load limit of 100 lbs.
3. Adjustable non-continuous cable support sling shall be suitable for use in air handling spaces.

2.8 TIE WRAPS AND VELCRO STRAPS

A. Tie Wraps and Velcro Straps:

1. Cables shall be fastened to support structures with tie wraps/Velcro straps.
2. Tie wraps/Velcro straps installed in air handling spaces must be plenum rated.

    a. Non-plenum Tie Wrap color shall be black.
    b. Plenum Tie Wrap color shall be red.
    c. Non-plenum Velcro strap color shall be black.
    d. Plenum Velcro strap color shall be red.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw upon approval of the structural engineer of record for the base of building. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed, except where permitted by the Project Manager as required by limited working space. X-ray all floor penetrations accordingly.

B. Holes shall be located so as not to affect structural sections such as ribs or beams.

C. Holes shall be laid out in advance. The Project Manager shall be advised prior to drilling through structural sections, for determination of proper layout.

D. Structural Penetrations: Where conduits, wireways and other raceways pass through fire partitions, fire walls or walls and floors provide a code compliant effective barrier against the spread of fire, smoke and gases.

E. All penetrations where conduit is not used shall be sleeved.

F. No gaps or rough edges shall be allowed between wall and conduit/sleeve.

3.2 CONDUIT SYSTEM

A. Conceal all conduits, except in unfinished spaces such as equipment rooms or as indicated by symbol on the Drawings.

B. Leave all empty conduits with a 200 pound test nylon cord pull line.

C. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.

D. Fasten conduit support device to structure with wood screws on wood, toggle bolts on hollow masonry, anchors as specified on solid masonry or concrete, and machine bolts, clamps, or spring steel clips, on steel.

E. Install conduit with wiring, including homeruns as indicated on the Drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a contract change. Deviations shall be made only where necessary to avoid interferences and when approved by Engineer by written authorization.

F. Conduit shall be run parallel or at right angles to existing walls, ceilings, and structural members.

G. Attach backbone conduits larger than one-inch trade diameter to or from structure on intervals not exceeding twelve feet with conduit beam clamps, one-hole conduit straps or trapeze type support.

H. Where conduits must pass through structural members obtain approval of Architect.

I. Install all conduits or sleeves penetrating or routed within rated firewalls or fire floors to maintain fire rating of wall or floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.

J. Provide expansion and deflection coupling where conduit passes over a building expansion joint.

K. Service entrance conduits and feeder conduits in direct contact with earth shall be schedule 40, heavy wall PVC. All service entrance conduit elbows shall be galvanized rigid steel. Service entrance conduits installed exposed or concealed in walls or above ceilings shall be galvanized rigid steel (G.R.S.) or intermediate metal conduit (IMC). Service entrance conduits shall be installed "outside" of the building as defined by the N.E.C. Provide concrete encasement where required or as indicated on Drawings.

L. All other conduit, unless specified herein, shall be electrical metallic tubing (EMT). PVC conduit is not allowed in exposed or concealed areas, but only within concrete.

M. Conduit Installations Within Slab/Floor:

1. Conduit shall be run following the most direct route between points.
2. Conduit shall not be installed in concrete where the outside diameter is larger than 1/3 of the slab thickness.
3. Conduits shall not be installed within shear walls unless specifically indicated on the Drawings. Conduit shall not be run directly below and parallel with load bearing walls.
4. Protect each metallic conduit installed in concrete slab or conduits 1-1/2 inch and smaller passing through a concrete slab against corrosion where conduit enters and leaves concrete by wrapping conduit with vinyl all-weather electrical tape.
5. Protect all conduits entering and leaving concrete floor slabs from physical damage during construction.
6. Provide expansion fittings in all conduits where length or run exceeds 200 feet or where conduits pass through building expansion joints.
7. Install all conduits penetrating or routed within rated fire floors to maintain the fire rating of the floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.
8. Conduits installed within concrete floor slabs which are in direct contact with grade or which penetrate the building roof shall be galvanized rigid steel (G.R.S.), intermediate metal conduit (I.M.C.) or Schedule 40, heavy wall PVC.

N. Communications cables shall not occupy conduits with power cables.

O. Metallic conduits shall be grounded in accordance with ANSI/TIA-607-B.

P. Conduit runs shall not have more than two (2) 90-degree bends between pull points.

Q. Communications conduit system shall contain no condulets (also known as an LB).

R. Rigid metal conduit (RMC) or intermediate metal conduit (IMC) shall be used for entrance conduits that exceed 50 feet into the building.

S. Horizontal Conduits:

1. Support horizontal conduits at intervals not exceeding ten feet and within three feet of each outlet, junction box, backboard, enclosure or cabinet. Support conduits from structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one-hole conduit straps. For exposed conduits and where conduits must be suspended below structure, single conduit runs shall be supported from structure by hanger rod and conduit clamp assembly, and multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.
2. For runs that total more than 100 feet in length, insert pull boxes so that no segment between boxes exceeds the 100 feet limit.

3.3 COMMUNICATIONS OUTLET BOXES

A. Exact locations of the outlet boxes shall be coordinated with the electrical contractor and other trades.

B. The approximate locations of the outlets are indicated on the Drawings. The exact locations shall be determined at the building. The right is reserved to change, without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.

C. Orientation of outlet boxes (horizontal or vertical) shall be as indicated on the architectural elevations.

D. Install all outlet boxes in finished areas flush with the wall. Maintain 1/4" or less space between outlet box front and finished wall surface.

E. Outlet boxes shall be firmly anchored in place and shall not depend on the coverplate to hold it secure to the wall.

F. Outlet boxes installed back-to-back in fire-rated walls shall be separated horizontally by a minimum of 12".

3.4 PULL BOXES

A. Pull boxes shall be secured, independent of the conduit entries into the box. Pull boxes shall be secured to the building structure. In ceiling applications, pull boxes shall not be supported with ceiling wires.

B. Conduits entering pull boxes shall connect to pull boxes using die-cast zinc connectors.

C. Pull boxes shall be free from burrs, dirt and debris.

D. Pull boxes shall be installed in accordance with ANSI/TIA-569-B.

E. Pull boxes shall be grounded in accordance with ANSI/TIA-607-B.

3.5 CABLE TRAY SYSTEM

A. Install trays in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of the NEC.

B. All open trays shall be installed a minimum of six (6) inches away from any light fixture.

C. Provide external grounding strap at expansion joints, sleeves, crossover and other locations where tray continuity is interrupted.

D. Support all pathways from building construction. Do not support pathways from ductwork, piping or equipment hangers.

E. Install cable tray level and straight.

F. Provide all hardware, accessories, fasteners, anchors, threaded rods and support channels required to provide a complete cable tray system.

G. Cable trays shall not be used to house both low voltage and power cables unless cables are separated by a grounded physical metal barrier.

H. Cable tray system shall be grounded in accordance with ANSI/TIA-607-B.

3.6 CABLE HANGERS

A. Installation and configuration shall conform to the requirements of ANSI/TIA-568-C.0, ANSI/TIA-568-C.1 & ANSI/TIA-569-B, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.

B. Install cables using techniques, practices, and methods that are consistent with Category 6 or higher requirements and that supports Category 6 or higher performance of completed and linked signal paths, end to end.

C. Install cables without damaging conductors, shield, or jacket.

D. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.

E. Pull cables without exceeding cable manufacturer's recommended pulling tensions. Use pulling means that will not damage media.

F. Do not exceed load ratings specified by manufacturer.

G. Adjustable non-continuous support sling shall have a static load limit of 100 lbs.

H. To avoid electromagnetic interference (EMI), pathways shall provide minimum clearances of four feet from motors or transformers, one foot from conduit and cables used for electrical power distribution, and five inches from fluorescent lighting. Pathways shall cross perpendicular to fluorescent lighting and electrical power cables or conduits.

3.7 TIE WRAPS AND VELCRO STRAPS

A. Tie wraps/Velcro straps shall be installed around cables at intervals of 12" minimum.

B. Tie wraps shall secure cables to cable trays using an "X" pattern.

C. Do not over-cinch cables.

3.8 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 05 28

SECTION 27 05 37
FIRESTOPPING FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Copper Horizontal Cabling.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

D. Related Specifications:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section including:

    a. Section 03 30 00 - Cast-In-Place Concrete
    b. Section 04 20 00 - Unit Masonry
    c. Section 07 84 00 - Firestopping
    d. Section 07 90 00 - Joint Sealants
    e. Section 09 20 00 - Plaster and Gypsum Board
    f. Section 13 48 00 - Sound, Vibration and Seismic Control
    g. Section 21 00 00 - Fire Suppression
    h. Section 27 00 00 – Communications
    i. Section 28 00 00 - Security

1.2 WORK INCLUDED

A. Only tested firestop systems shall be used in specific locations as follows: Penetrations for the passage of cables, conduit, and other electrical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

1.3 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.4 REFERENCES

A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"

B. Test Requirements: UL 1479, “Fire Tests of Through-Penetration Firestops”

C. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:

a. Firestop Devices (XHJI)
b. Fire Resistance Ratings (BXRH)
c. Through-Penetration Firestop Systems (XHEZ)
d. Fill, Voids, or Cavity Material (XHHW)
e. Forming Materials (XHKU)

D. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

E. Inspection Requirements: ASTM E 2174, “Standard Practice for On-site Inspection of Installed Fire Stops.”

F. Test Requirements: ASTM E 90, “Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements”

G. Test Requirements: ASTM E 2178, “Standard Test Method for Air Permeance of Building Materials”

H. Test Requirements: ASTM E 84, “Standard Test Method for Surface Burning Characteristics of Building Materials.”

I. Test Requirements: ASTM E 2178, “Standard Test Method for Air Permeance of Building Materials”

J. International Building Code (IBC 2009)

K. NFPA 101 - Life Safety Code

L. NFPA 70 - National Electric Code

1.5 QUALITY ASSURANCE

A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection

and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation must meet requirements of ASTM E 814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.6 SUBMITTALS

A. Submit Product Data: Manufacturer’s specifications and technical data for each material including the composition and limitations, and manufacturer's installation instructions to comply with Section 01 30 00.

B. Submit qualified tested firestop system detail for each firestop application on the project.

C. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment must include both project name and contractor’s name who will install firestop system as described in drawing.

D. Submit material safety data sheets provided with product delivered to job-site.

1.7 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A manufacturer’s willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature limitations.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.9 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Scheduling:

1. Schedule installation of cast-in place firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Provide a round enclosed fire rated cable management device whenever cable bundles penetrate fire rated walls. The cable management device shall contain integrated intumescent firestop wrap strip materials sufficient to maintain the hourly rating of the barrier being penetrated. The cable management device shall contain a smoke seal fabric membrane or intumescent firestop plugs sufficient to achieve the L-Rating requirements of the barrier type.

D. Provide non-curing, re-penetrable, intumescent firestop materials around communications cable trays or ladder racks penetrating through a fire rated wall. The firestop system assembly shall be able accessible and re-installed from one side of the wall. The firestop material shall allow up to 12” of unreinforced annular space.

E. Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

1. F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.

F. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

1. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
2. T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
3. W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.

G. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.

H. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.

2.2 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma
   800-879-8000
   www.us.hilti.com
2. Provide products from the above acceptable manufacturer; *no substitutions will be accepted.*

2.3 MATERIALS

A. Use only firestop products that have been UL 1479 or ASTM E 814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Re-penetrable, cable management products for use with new cable bundles penetrating gypsum or masonry walls, the following products are acceptable:

1. Hilti Speed Sleeve (CP 653) for openings equal to or less than 4” diameter.
2. Hilti Firestop Block (CFS-BL) for openings larger than 4” diameter.
3. Hilti Gangplate (CFS-SL GP) for use with multiple cable management devices.

C. Re-penetrable, cable management products for use with pre-existing (retrofit) cable bundles penetrating gypsum or masonry walls, the following products are acceptable:

1. Hilti Firestop Retrofit Sleeve Kit (CFS-SL RK) for sleeved openings equal to or less than 4” diameter.
2. Hilti Firestop Cable Collar (CFS-CC) for un-sleeved openings equal to or less than 4” diameter.
3. Hilti Firestop Block (CFS-BL) for openings larger than 4” diameter.

D. Pre-formed, round firestop devices with integrated intumescent strips for use with noncombustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors and/or gypsum walls, the following products are acceptable:

1. Hilti Cast-In Place Firestop Device (CP 680-P) for use with combustible penetrants.
2. Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
3. Hilti Speed Sleeve (CP 653) for use with cable penetrations.
4. Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.

E. Sealants, foams or caulking materials for use with non-combustible items including rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:

1. Hilti Intumescent Firestop Sealant (FS-ONE)
2. Hilti Fire Foam (CP 620)
3. Hilti Flexible Firestop Sealant (CP 606)
4. Hilti Elastomeric Firestop Sealant (CP 601S)

F. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including PVC jacketed, flexible cable or cable bundles, and plastic pipe, the following products are acceptable:

1. Hilti Intumescent Firestop Sealant (FS-ONE)

G. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti Intumescent Firestop Sealant (FS-ONE)
2. Hilti Fire Foam (CP 620)
3. Hilti Flexible Firestop Sealant (CP 606)
4. Hilti Elastomeric Firestop Sealant (CP 601S)

H. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti Firestop Putty Stick (CP 618)
2. Hilti Firestop Plug (CFS-PL)

I. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:

1. Hilti Firestop Putty Pad (CP 617)
2. Hilti Firestop Box Insert

J. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. Hilti Firestop Mortar (CP 637)
2. Hilti Firestop Block (CFS-BL)
3. Hilti Fire Foam (CP 620)
4. Hilti Firestop Board (CP 675T)

K. Non curing, re-penetrable materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. Hilti Firestop Block (CFS-BL)
2. Hilti Firestop Board (CP 675T)

L. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:

1. Hilti Firestop Block (CFS-BL)
2. Hilti Firestop Plug (CFS-PL)

PART 3 - EXECUTION

3.1 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.
2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
5. Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

3.3 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

2. Protect materials from damage on surfaces subjected to traffic.

3.4 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.5 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION 27 05 37

SECTION 27 05 53
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the equipment and execution requirements relating to Identification for Communications Systems.

C. Equipment specifications, general considerations, and guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 – PRODUCTS

2.1 LABELING REQUIREMENTS

A. Labeling shall be done in accordance with the recommendations made in the ANSI/TIA-606-A document, manufacturer's recommendations and best industry practices.

B. All indoor labels shall be clear with black text. All outdoor labels will be designed for outdoor use. Manhole labels will be metal tags.

C. Termination racks and equipment cabinets shall be labeled according to the drawings with engraved black on white plastic nameplates at the top of the enclosure. ¼” font minimum.

D. Patch panels shall be labeled according to the drawings and industry standards to identify each panel starting from the top of the enclosure. ¼” font

E. All cabinet mounted communications equipment shall be labeled. ¼” font

F. All cables shall be labeled with machine generated, 12 pt font, wrap around self protecting labels.

G. A total of three no less then (3) labels per horizontal cable are required at the following intervals: 6" from termination of cable at outlet and block/patch panel and at all penetrations.

H. Labeling scheme shall be alphanumeric and approved by project manager.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide and generate all labeling per EIA/TIA 606-A (no labels will be furnished by the Owner).

B. Labels shall be developed and printed using a software program.

C. Software program and all in-puts shall be turned over to the Owner at the end of the project.

3.2 INSTALLATION

A. All labels shall be installed straight.

B. Provide labels at locations as indicated on the drawings and as follows:

1. Outlet face plates
2. Outlet cable inside box
3. Outlet cable at rear of patch panel
4. Port on front of patch panel
5. Front of fiber patch panel
6. Fiber optic cable at rear of fiber optic patch panel
7. Riser cables whenever exposed on minimum 10' intervals
8. Riser cable at point of termination
9. Cables at voice blocks
10. Ends of any cable put in place that is not terminated
11. On front of racks and cabinets frames
12. Patch cords (both ends)
13. Cables in manholes stating serving and destination locations
14. All spaces, pathways, termination hardware, grounding system and equipment shall be labeled.
15. On ceiling grid below location where an “above ceiling” outlet is installed.

3.3 TEMPORARY LABELS

A. Provide temporary labels on all outlet cables as it is roughed-in.

3.4 TEXT SIZE AND INFORMATION

A. Text size should be as large and as bold as possible.

B. Exact text required information is shown on the drawings.

C. All outlet, outlet cables, and riser cables labels shall contain:

1. Designation number
2. "To" and "From" information
3. Room numbers

3.5 LABELING REFERENCE CHARTS

A. Contractor to provide a labeling reference chart(s) indicating the following:

1. Voice riser termination of pairs at each end
2. Voice outlet cable pair termination at the voice block
3. Data patch panel outlet port termination
4. Fiber riser terminations at each end

3.6 AS BUILT DOCUMENTATION

A. Contractor to add labeling information to as built drawings at end user locations.

END OF SECTION 27 05 53

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SECTION 27 08 00
COMMISSIONING OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the equipment and execution requirements relating to Commissioning of Communications.

C. Equipment specifications, general considerations, and guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - TESTING

2.1 TESTING REQUIREMENTS

A. General:

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA-568-C.0, ANSI/TIA-568-C.1, and/or ANSI/TIA-1152. All conductors/strands of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors/strands in all cables installed.

B. Copper Testing:

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required

to verify Category 6 performance. Horizontal balanced twisted pair cabling shall be tested using a level IIe, III, or IV test unit for category 6 performance compliance.

2. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. The test shall be recorded as pass/fail as indicated by the test unit and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
3. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA-568-C.2 Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
4. Approved tester is as follows:
   Fluke DTX

C. Fiber Testing:

1. All fiber testing shall be performed on all fibers in the completed end-to-end system. There shall be no splices unless clearly defined in the Specifications and/or Drawings. These tests also include continuity checking of each fiber.
2. Multimode:

   a. Test the optical fiber cable bi-directionally and uni-directionally with a Fluke DTX. Fiber must be tested at both 850nm and 1300nm. Maximum attenuation dB/Km @ 850nm/1300nm shall be 3.5/1.5. Maximum attenuation per connector pair shall be .75 dB. Attenuation testing shall be performed with a stable launch condition using a one-meter or two-meter jumper, wrapped around a mandrel sized according to fiber type, to attach the light source to the cable plant. Fiber jumper shall be wrapped around mandrel no less than five (5) times. The jumper-mandrel assembly shall remain connected to the light source after calibration and the power meter moved to the far end using a new jumper to take measurements. Test set-up and performance shall be conducted in accordance with ANSI/TIA-568-C.3, and to the manufacturer's application guides.

3. Singlemode:

   a. Test the optical fiber cable bi-directionally with an OTDR and uni-directionally with a power meter/light source. Fiber must be tested at both 1310nm and 1550nm. Maximum attenuation dB/Km @ 1310nm/1550nm shall be 0.5/0.5 for outside plant and 1.0/1.0 for inside plant. Maximum attenuation per connector pair shall be .75 dB. Attenuation testing shall be performed with a stable launch condition using one-meter or two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements. Test set-up and performance shall be conducted in accordance with ANSI/TIA-568-C.3, and to the manufacturer's application guides.

4. Approved optical fiber test equipment manufacturers are as follows:

   a. Power Meters & Light Sources
      Optical Wavelength Laboratories (OWL)
      Photonix
      Fluke
      Agilent
   b. Optical Time Domain Reflectometers (OTDR)
      GN Nettest
      Agilent
      Fluke
      Anritsu
      Fiber Instrument Sales - Model # OVHQUAD

D. Test Results:

1. Test documentation shall be provided in 3 hard copies and 3 electronic copies on disk as part of the as-built package. The disk shall be clearly marked on the outside front cover with the words “Project Test Documentation,” the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair (or strand) and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
2. The field test equipment shall meet the requirements of ANSI/TIA-568-C.2, ANSI/TIA-568-C.3, and/or ANSI/TIA-1152.
3. Three bound printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. These CDs shall contain the electronic equivalent of the test results as defined by the Specification and be of a format readable from Microsoft Word.
4. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

PART 3 - DOCUMENTATION, AS-BUILTS, TRAINING AND RECORDS

3.1 DOCUMENTATION AND AS-BUILTS

A. As-Built record documentation for communications work shall include:

1. Cable routing and identification
2. End user outlet labeling
3. System function diagrams
4. Manufacturers' description literature for equipment
5. Connection and programming schedules as appropriate
6. Equipment material list including quantities
7. Spare parts list with quantities
8. Details not on original Contract Documents

9. Test results
10. Warranties
11. Release of liens

B. The Contractor shall provide and maintain at the site a set of prints on which shall be accurately shown the actual installation of all work under this section, indicating any variation from contract drawings, including changes in pathways, sizes, locations and dimensions. All changes shall be clearly and completely indicated as the work progresses.

C. Progress prints shall be available for inspection by the Owner or any of his representatives and may be used to determine the progress of communications infrastructure work.

D. At the completion of the work, prepare a new set of as-built drawings, of the work as actually noted on the marked-up prints, including the dimensioned location of all pathways.

E. Furnish as-built drawings and documentation to the Project Manager. As-built drawings shall be generated in AutoCad 2006 or later. Submit 3 copies of as-built drawings electronically on C.D. and hard copy.

3.2 OPERATIONS AND MAINTENANCE MANUAL

A. After completion of the work, the Contractor shall furnish and deliver to the Engineer three (3) copies of a complete Operations & Maintenance Manual. A system wiring diagram shall be furnished for each separate system.

B. The manual shall be subdivided into separate sections with tab dividers to identify subsystems of the integrated system. Reference appropriate Specification sections.

C. Provide the following additional information for each electronic system. Information shall be edited for this project where applicable.

1. Operations manuals for components and for systems as a whole.
2. Maintenance manuals for components and for system as a whole.
3. Point-to-point diagrams, cabling diagrams, construction details and cabling labeling details.
4. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
5. Emergency instructions for operational and maintenance requirements.
6. Delivery time frame for replacement of component parts from suppliers.
7. Recommended inspection schedule and procedures for components and for system as a whole.
8. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
9. Complete “reviewed” shop drawings and product data for components and system as a whole.
10. Troubleshooting procedures for each system and for each major system component.

3.3 TRAINING

A. The Contractor shall be responsible for training of facility personnel. Training shall take place after occupancy and before acceptance and shall include programs for on-site operations and maintenance of technology and communications systems. Training shall be for not more than ten (10) people, shall be held at the Owner's site and shall be of sufficient duration and depth to ensure that the trained personnel can operate the installed systems and can perform usual and customary maintenance actions. The contractor shall record the training and provide (3) DVD copies of the training to the project manager.

3.4 WARRANTY

A. General:

1. All equipment is to be new and warranted free of faulty workmanship and damage.
2. Replacement of defective equipment and materials and repair of faulty workmanship within 24 hours of notification, except emergency conditions (system failures), which must be placed back in service within eight (8) hours of notification, all at no cost to the Owner.
3. The minimum warranty provisions specified shall not diminish the terms of individual equipment manufacturer's warranties.

B. Voice and Data Structured Cabling:

1. Manufacturer(s) shall provide a minimum 25-year warranty for components used in the installed Voice & Data Structured Cabling System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

C. Coaxial Cabling Infrastructure:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Coaxial Cabling Infrastructure. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

D. CATV Distribution System:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed CATV Distribution System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

E. Audio-Visual Systems:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Audio-Visual Systems. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

F. Overhead Paging System:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Overhead Paging System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

G. Sound Masking System:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Sound Masking System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

H. Network Equipment:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed WAN and LAN Network equipment. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

I. Voice Equipment:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Voice equipment. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

J. Wireless Access System:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Wireless Access System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

K. Emergency Phones / Call Boxes:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Emergency Phones / Call Boxes. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

L. Pathway and Support Infrastructure:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Pathway & Support Infrastructure. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

END OF SECTION 27 08 00

SECTION 27 11 00
COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Scope of Work:

1. The spaces required for technology systems support are defined in this document and the project drawings. They generally fall into specific areas as follows; Telecommunications Entrance Room (TSER), Equipment Room (ER), Main Distribution Frame (MDF), Intermediate Distribution Frame (IDF) or Horizontal Connection (HC) and Data Center MDA and HDA. In many cases the purpose of these room are combined to operate efficiently. All spaces work together to form the framework and infrastructure required for the complete and operational technology platform.

B. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Telecommunications service entrance pathways.
5. Grounding.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. BICSI: Building Industry Consulting Service International.

C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel not exceeding 6 inches in width.

D. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

E. LAN: Local area network.

F. RCDD: Registered Communications Distribution Designer.

G. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of a bottom without ventilation openings within integral or separate longitudinal side rails.

H. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Interface details: Include rack/cabinet locations, wall mounted equipment, overhead cable tray, lighting fixtures, and power interface.
4. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

C. Qualification Data: For installer, qualified layout technician, installation supervisor, and field inspector.

D. Seismic Qualification Certificates: For floor-mounted cabinets, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

D. Grounding: Comply with ANSI-J-STD-607-A.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weather-tight, wait until work in spaces is complete and dry, and work above ceilings is complete.

1.7 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.

1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
2. Support brackets with cable tie slots for fastening cable ties to brackets.
3. Lacing bars, spools, J-hooks, D-rings and waterfalls.

4. Straps and other devices.

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
2. Each equipment rack or cabinet will have two (2) dedicated 120 Volt, 20 amp circuits from the emergency power distribution system or UPS.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches installed 6” above finished floor, AFF. Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry" on all 4 walls of the technology spaces.

2.3 FIRESTOPPING

A. Sleeves:

1. Specified Technologies, Inc., EZ Path.

a. Series 22
b. Series 33
c. Series 44

2. Hilti, Speed Sleeve

a. CP 653/236323
b. CP 653/236324
c. CP 658/3409155
d. CP 658/3409157

B. Mechanical Firestop Appliances:

1. Dorn Equipment Corp, FirSto

a. FSP Series

C. Firestop Material

1. Hilti, Firestop Plug (removable)

a. CFS-PL Series

2.4 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with ANSI-J-STD-607-A.

2.5 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and housing when so directed by service provider.

B. Install underground pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

C. Install underground entrance pathway complying with Division 26 Section "Raceway and Boxes for Electrical Systems."

3.2 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

C. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping". Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.

B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

C. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

D. Labels shall be preprinted or computer-printed type.

END OF SECTION 27 11 00

SECTION 27 11 13
COMMUNICATIONS ENTRANCE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Entrance Protection.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.4 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Building Entrance Protector Terminal Manufacturer(s):

1. Circa
2. Marconi
3. Porta Systems

B. Approved Bonding Shield Connector Manufacturer(s):

1. 3M

2. Or Approved Equal

2.2 BUILDING ENTRANCE PROTECTOR TERMINALS

A. Indoor Building Entrance Protector Terminal:

1. The indoor building entrance protector terminal shall be equipped with 110-connector inputs and outputs and shall accommodate industry standard 5-pin protection modules.
2. The indoor building entrance protector terminal shall protect up to 100-pairs and shall be equipped with an internal fuse link.
3. The indoor building entrance protector terminal shall be wall or frame mountable, and able to be stacked for future expansion.
4. The indoor building entrance protector terminal shall be equipped with external ground connectors that accept 6-14 AWG ground wire.

B. Solid State Surge Protection Modules:

1. The solid-state surge protector module shall be 5-pin and shall provide transient and power fault protection for standard telephone line applications.
2. The solid-state surge protector module shall be designed to provide a balanced configuration to protect against line-to-line metallic surges.
3. The solid-state surge protector module shall feature an external failsafe mechanism, which permanently grounds module under sustained high current conditions.
4. The solid-state surge protector module shall feature nanosecond response time and safe mode operation in adverse situations.
5. The solid-state surge protector module shall be UL & UL Listed.

2.3 BONDING SHIELD CONNECTOR

A. Shield Connector:

1. The purpose of the bonding shield connector is to make a stable, low resistant electrical connection between the shield of a communications cable and a ground conductor.
2. The bonding shield connector shall be tin-plated tempered brass.

PART 3 - EXECUTION

3.1 BUILDING ENTRANCE PROTECTOR TERMINALS

A. All copper circuits shall be provided with protection between each building with an entrance cable protector panel. All building-to-building circuits shall be routed through this protector. The protector shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the telecommunications room (TR) busbar (TMBB).

B. Building entrance protector shall be installed in accordance with the recommendations contained in the ANSI/TIA-607-B Telecommunications Bonding and Ground Standard.

C. Building entrance protector panels shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.2 BONDING SHIELD CONNECTOR

A. Bonding shield connector shall be installed in accordance with the recommendations contained in the ANSI/TIA-607-B Standard.

B. Bonding shield connector shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.3 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 11 13

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SECTION 27 11 16
COMMUNICATIONS CABINETS, RACKS AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 26 – Electrical and Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Cabinets, Racks and Enclosures.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 SUBMITTALS

A. Provide product data from manufacturer’s specifications.

1.4 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Equipment Rack/Cabinet/Shelf Manufacturer(s):

1. Chatsworth Products

2.2 EQUIPMENT RACKS/CABINETS/SHELVES

A. Equipment Racks:

1. The equipment rack shall be constructed of high strength steel.
2. The vertical rails of the equipment rack shall be equipped with the EIA hole pattern. Each rack will include 100 each combination pan head mounting screws.
3. Each equipment rack requires (1) 20 Amp circuits, provided by others.
4. Rack shall be: 7' H x 19" W x 6” deep and floor mounted.
5. Rack color shall be black and contain 45 RU of mounting space.
6. Racks shall include both vertical and horizontal cable management systems as shown on the drawings.

B. Equipment Cabinets: (see drawings for part numbers and additional requirements)

1. The frame of the equipment cabinet shall be constructed of high strength, lightweight aluminum or high strength steel.
2. Front and rear doors of the equipment cabinet shall be key lockable.
3. All cabinets on this project will be keyed alike unless otherwise noted.
4. The vertical 19” mounting rails of the equipment cabinet shall be equipped with the EIA hole pattern and will include 100 each mounting screws.
5. Each cabinet requires (2) 20 Amp circuits, provided by others.
6. The equipment cabinet shall be equipped with a fan unit.
7. Cabinet shall be: 7' H x 24" W x 30" D floor mounted with 45 RU.
8. Cabinet color shall be black, unless specified elsewhere.

C. Single-Sided Equipment Shelves:

1. The single-sided equipment shelf shall be constructed of high strength, lightweight aluminum.
2. The single-sided equipment shelf shall be a minimum depth of 15".
3. The single-sided equipment shelf shall support a minimum of 50lbs.
4. Single-Sided Equipment Shelf color shall be black.

PART 3 - EXECUTION

3.1 EQUIPMENT RACKS/CABINETS/SHELVES

A. Equipment racks shall be securely attached to the concrete floor using minimum 3/8" hardware or as required by local codes.

B. Equipment racks will have double sided, 4” vertical cable management systems on each side of them. CMS will be finger type with covers.

C. Equipment cabinets shall be installed as per the requirements specified by the manufacturer's installation guidelines.

D. Equipment racks/cabinets shall be placed with a minimum of 36-inch clearance from the walls from the front and rear of the rack or as indicated on Drawings.

E. All equipment racks/cabinets shall be grounded to the telecomm ground bus bar.

F. Mounting screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

3.2 BACKBOARDS

A. Backboards shall be fire-rated 3/4" void free plywood. Size of backboard shall be 4' x 8', mounted 6” AFF unless noted differently on Drawings. Backboards shall be painted with two (2) coats of light gray fire-retardant paint. Do not paint over label.

3.3 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Comm Systems for labeling details.

END OF SECTION 27 11 16

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SECTION 27 11 19
COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Termination Blocks and Patch Panels.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 SUBMITTALS

A. Provide product data from manufacturer’s specifications.

1.4 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Patch Panel Manufacturer(s):

1. TE Connectivity
2. Panduit

B. Approved Optical Fiber Enclosure Manufacturer(s):

1. Corning,

C. Approved Termination Block Manufacturer(s):

1. TE Connectivity
2. Panduit

2.2 PATCH PANELS

A. Category 6A Patch Panel:

1. The Category 6A patch panel shall be compatible with 19" equipment racks, cabinets or wall mount brackets and provide for 48 ports unless otherwise noted on the drawings.
2. The Category 6A patch panel shall be equipped with 8-position modular ports and shall allow for termination using either T568A and T568B wiring schemes. All UTP cabling will be terminated 568B.
3. The Category 6A patch panel shall be equipped with front labeling space to facilitate port identification.
4. The connector module shall meet or exceed the Category 6A performance criteria per ANSI/TIA-568-C.2.
5. All patch panels will have double sided, 2 RU cable management panels above and below them. Install CMS covers when installation is complete.
6. All patch panels designated for security camera system shall be unloaded panels with orange color keystone Category 6A jacks in each port, even spare ports.

2.3 OPTICAL FIBER PANELS/ENCLOSURES

A. Rack Mount Optical Fiber Panel/Enclosure:

1. The rack mount optical fiber panel/enclosure shall be equipped with either a swing out mechanism or a sliding drawer to access fibers.
2. The rack mount optical fiber panel/enclosure shall be capable of terminating tight-buffered or loose tube optical fiber cable.
3. The rack mount optical fiber panel/enclosure shall provide for bend radius control throughout the panel as well as storage space for slack cabling.
4. The panel/enclosure shall meet or exceed the performance criteria per ANSI/TIA-568-C.3.
5. The rack mount optical fiber panel/enclosure shall be equipped with optical fiber adapter panels.

    a. The optical fiber adapter panels shall accommodate either multimode or singlemode terminated optical fiber.
    b. The optical fiber adapter panels shall be compatible with ST, LC SC or APC connectors as indicated on the drawings.
    c. OM1 & OM2 multimode adaptors shall be beige in color and equipped with phosphor bronze sleeves.
    d. OM3 & OM4 laser optimized adaptors shall be aqua in color and equipped with zirconia ceramic sleeves.
    e. Singlemode adaptors shall be blue or green in color and equipped with zirconia ceramic sleeves.

2.4 TERMINATION BLOCKS

A. 110 Type Wiring Blocks/Cross-Connect Kits:

1. The 110-type wiring blocks shall be available in 100- and/or 300-pair configurations.
2. The 110-type wiring block shall be compatible with Category 6.
3. The cross-connect kits shall include all the components required to complete a wall-mounted 110 cross-connect installation and be available in both 100- and/or 300-pair configuration. (Includes 110-blocks, connecting blocks and designation strips).
4. The termination block shall meet or exceed the performance criteria per ANSI/TIA-568-C.2.
5. Backbone blocks shall use 5-pair connecting blocks on each 25-pair row.
6. Horizontal blocks shall use 4-pair connecting blocks on each 25-pair row.

PART 3 - EXECUTION

3.1 PATCH PANELS

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practice.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective patch panel. Each patch panel shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.2 OPTICAL FIBER PANELS/ENCLOSURES

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practices.

B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

C. Bend radius of the optic fiber cable in the panel/enclosure shall not exceed 10 times the outside diameter of the cable.

D. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

E. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

F. A maximum of 12 strands of fiber shall be spliced in each tray

G. All spare strands shall be installed into spare splice trays.

H. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

3.3 TERMINATION BLOCKS

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practice.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective termination block. Each termination block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. Each cable shall be clearly labeled on the cable jacket within 12" of the termination block at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

F. Wall mounted termination block fields shall be mounted on communications backboard and labeled using industry standard 25 pair labeling strips.

G. Wall mounted termination block fields shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.4 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 11 19

SECTION 27 11 23
COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Cable Management and Ladder Rack.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.4 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Horizontal Cable Management Manufacturer(s):

1. TE Connectivity, Basis of Design (No substitutions)

B. Approved Vertical Cable Management Manufacturer(s):

1. TE Connectivity, Basis of Design (No substitutions)

C. Approved Ladder Rack System Manufacturer(s):

1. Chatsworth Products, Inc.
2. B-Line
3. Hoffman

D. Approved Tie Wrap/Velcro Strap Manufacturer(s):

1. Thomas & Betts

E. Approved C-Ring/D-ring Manufacturer(s):

1. Chatsworth Products, Inc.

2.2 CABLE MANAGEMENT - HORIZONTAL

A. Horizontal Cable Management:

1. The horizontal wire manager shall be compatible with 19-inch equipment racks, cabinets or wall mount brackets.
2. The horizontal cable manager shall be double sided and provide support for patch cords at the front and horizontal cables at the rear of the panel.
3. The horizontal cable manager shall be 2 rack-units in height when matched with a 2 rack-unit patch panel or any switch.
4. The horizontal cable manager shall be 1 rack-unit in height when matched with a 1 rack-unit patch panel.

2.3 CABLE MANAGEMENT - VERTICAL

A. Vertical Cable Management:

1. The vertical cable manger shall be double-sided.
2. The vertical cable manager shall provide support for patch cords at the front of the rack and wire management at the rear of the rack.
3. The vertical cable manager shall be a minimum width of 4" and 6” deep.
4. Vertical cable manager color shall be black.

2.4 LADDER RACKS

A. Ladder Rack System:

1. See Drawings for ladder rack system details.
2. The ladder rack system shall be securely mounted to the walls and the overhead with hardware designed for use in ladder rack systems.
3. End caps shall be installed on the exposed ends of the ladder racks, channel supports and bolts. Protective covers shall be installed on threaded rods that come in contact with cabling plant.
4. Ladder Rack System color shall be black.

2.5 TIE WRAPS AND VELCRO STRAPS

A. Tie Wraps and Velcro Straps:

1. Backbone cables shall be fastened to support structures with Velcro straps.
2. Horizontal cables shall be fastened to support structures with Velcro straps.

a. NO! plastic Tie Wraps shall be left on cables.
b. Velcro Strap color shall be black.

2.6 DISTRIBUTION RINGS

A. Distribution Rings:

1. Distribution Rings shall be used on backboards to support cables, patch cords and cross-connect wire.
2. Distribution Rings shall be made of high-strength, fire-retardant material with rounded edges to prevent damage to cable and wire insulation.

PART 3 - EXECUTION

3.1 CABLE MANAGEMENT - HORIZONTAL

A. Horizontal cable managers shall be installed starting with one above and then proceeding with one below each patch panels in a 1:1 ratio (one horizontal cable manager per patch panel) or as indicated on Drawings.

3.2 CABLE MANAGEMENT - VERTICAL

A. Vertical cable managers shall be installed on both sides of a single equipment rack. Where two (2) or more racks are positioned in a row, vertical cable managers shall be installed between each rack and each end of the row.

3.3 LADDER RACKS

A. Ladder rack system shall be installed straight, level and perpendicular to walls and ceiling slabs.

B. Ladder racks shall be supported at 5' intervals maximum.

C. Provide all hardware, accessories, fasteners, anchors, threaded rods and support channels required to provide a complete ladder rack system.

D. See Drawings for ladder rack system details.

3.4 TIE WRAPS AND VELCRO STRAPS

A. Velcro straps shall be installed around cables at intervals of 12" minimum.

B. Velcro straps shall secure cables to ladder racks using an “X” pattern.

C. Do not over-cinch cables.

3.5 DISTRIBUTION RINGS

A. Distribution Rings shall be installed on backboard, straight and level.

3.6 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 11 23

SECTION 27 11 26
COMMUNICATIONS RACK MOUNTED POWER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Rack Mounted Power Distribution.

C. Product Specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.4 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Power Distribution Unit Manufacturer(s):

1. APC

B. Approved Rack Mounted UPS Manufacturer(s):

1. APC
2. Liebert
3. Powerware

2.2 POWER DISTRIBUTION UNITS

A. Power Distribution Unit, Rack mounted:

1. The power distribution unit shall be equipped with a minimum of twelve (12) 3-prong, 120 VAC outlets, 7' cord and shall not have an on/off switch.
2. The power distribution unit shall be equipped with surge protection with a 20 Amp current limit.
3. The power distribution unit shall be equipped with a bracket that enables it to be mounted horizontally on a 19" rack or wall mount bracket without modification.

B. Power Distribution Unit, Cabinet mounted:

1. The power distribution unit shall be equipped with a minimum of twelve (12) 3-prong, 120 VAC outlets, 7' cord and shall not have an on/off switch.
2. The power distribution unit shall be equipped with surge protection with a 20 Amp current limit.
3. The power distribution unit shall be equipped with a bracket that enables it to be mounted vertically in cabinet without modification.

PART 3 - EXECUTION

3.1 POWER DISTRIBUTION UNITS

A. Power distribution units shall be installed as per the requirements specified by the manufacturer's installation guidelines.

B. See Drawings for installation location on rack(s)/cabinet(s).

3.2 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 11 26

SECTION 27 13 13
COMMUNICATIONS COPPER BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Copper Backbone.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.4 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Copper Backbone Cable (Inside Plant) Manufacturer(s):

1. TE/Commscope,
2. Panduit

B. Approved Copper Backbone Cable (Outside Plant) Manufacturer(s):

1. TE/Commscope,
2. Panduit

2.2 COPPER BACKBONE CABLE (INSIDE PLANT)

A. 100-Ohm Balanced Twisted Pair Building Backbone Cables (Inside Plant):

1. Generic Characteristics:

a. The inside plant, balanced twisted pair building backbone cable shall meet the 100-Ohm balanced twisted pair backbone requirements per the latest issue of ANSI/TIA-568-C.2.
b. The inside plant, 100-Ohm balanced twisted pair cable shall be CMR or CMP rated (according to the space it occupies).
c. The inside plant, balanced twisted pair building backbone cable core shall consist of 25-pair sub-units.

2.3 COPPER BACKBONE CABLE (OUTSIDE PLANT)

A. 100-Ohm PE-89 Backbone Cables (Outside Plant):

1. Generic Characteristics:

a. The outside plant backbone cable shall be assigned the RDUP designation of PE-89.
b. The outside plant backbone cable core shall consist of 25-pair sub-units.
c. The outside plant backbone cable shall contain water-blocking gel and have a jacket made of polyethylene.

PART 3 - EXECUTION

3.1 BACKBONE CABLES (INSIDE PLANT)

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practices.

B. Backbone cables shall be installed separately from horizontal distribution cables

C. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.

D. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits.

E. Exposed cables must be CMP or MMP rated if installed in an air return plenum. CMR rated cables shall be installed in metallic conduit if installed in an air return plenum.

F. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.

G. Leave 10' of slack on each end of copper backbone cable.

H. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.

I. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

J. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.

K. Copper cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

L. Each copper cable shall be clearly labeled on the cable jacket behind the patch panel or block at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.2 BACKBONE CABLES (OUTSIDE PLANT)

A. All OSP cables brought to the Entrance Facilities shall have 15 ft of slack coiled and secured to the wall in the proximity of the termination field.

B. All OSP cables will have slack cable routed twice around and attached to the walls of every other maintenance hole.

C. All cables shall be tagged and identified within each handhole / maintenance hole.

D. Place initial cables in bottom conduits to facilitate easy subsequent cable placement.

E. Place leader guard in the duct before placing cable to prevent damaging the cable sheath on the sharp edge of the duct.

F. Ventilate maintenance holes where gas has been detected before entering the space.

G. A 600 lb. break-away swivel, along with a slip clutch capstan winch that shows the dynamometer (pulling tension) reading, shall be used at all times during pulling.

H. At each splice location the cable ends will be sealed watertight at all times. Reels will be continuously manned during cable installation.

I. Copper backbone cables shall be bonded and grounded in accordance with the recommendations made in the ANSI/TIA-607-B standard, manufacturer's recommendations and best industry practice.

3.3 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 13 13

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SECTION 27 13 23
COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. General: Furnish and install complete with all accessories an ANSI/TIA-568-C fiber optic Backbone Distribution System (BDS). The BDS system shall serve as a vehicle for transport of data, video, and voice telephony signals throughout the building from designated demarcation points to MDF, MDA and IDF's as indicated on the contract drawings and described herein. Application standards supported shall be IEEE 802.3ab (1000Base-T) and IEEE 802.3z (1000Base-SX and 1000Base-LX). Approved product lines are listed in the product sections. In addition, these links/channels shall meet the requirements outlined in this specification.

B. General: The system shall utilize a network of fiber optic cables. Cables and terminations shall be provided and located as shown and in the quantities indicated on the drawings. Cables shall terminate on rack mounted Fiber Distribution Centers (FDC's) as shown on the drawings. All cables and terminations shall be identified at all locations. All cables shall be terminated in an alpha-numeric sequence at all termination locations. All terminations shall comply with, and be tested to ANSI/TIA-568C standards for fiber optic installations.

C. For this contract a single optical channel solution shall be installed for the entire project. Contractor shall install a Corning OM-4 and/or OS-2 solution for inside fiber optical plant. Contractor shall install a Corning OS-2 solution for outside fiber optical plant.

D. Work Included: Wiring, terminations and patch bays between these designated demarcation points and outlet locations designated on the plans shall be considered part of the contact and shall be furnished, wired and installed by the BDS contractor.

1.3 STANDARDS

A. ANSI/TIA-568C "Generic Telecommunications Cabling for Customer Premises"

B. ANSI/TIA-568C.1 "Commercial Building Telecommunications Cabling System Standard"

C. ANSI/TIA-568-C.2 "Balanced Twisted Pair Telecommunications Cabling Systems Standard"

D. ANSI/TIA-568-C.3 "Optical Fiber Telecommunications Cabling Systems Standard"

E. ANSI/TIA-569-B "Commercial Building Standard for Telecommunications Pathways and Spaces"

F. ANSI/TIA-606-B “Administration Standard for Telecommunications Infrastructure of Commercial Buildings”

G. ANSI/TIA-607-A “Commercial Building Grounding/Bonding Requirements”.

H. ANSI/NFPA 70 National Electrical Code, CSA C22.1.

I. BICSI Telecommunications Distribution Methods Manuals

J. BICSI Telecommunications Installation Manuals

K. County Codes and Regulations.

L. Underwriters Laboratories (UL)

M. FCC -Federal Communications Commission

N. ADA Requirements

O. Occupational Safety and Health Regulations (OSHA)

P. National Fire Protection Association (NFPA)

Q. Texas Statutes and Administrative Rules

R. Connectivity Manufacturer’s Certified Cabling System Manual

1.4 CONTRACTOR QUALIFICATIONS

A. General: The contractor selected for the Project must be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning the Project. Contractor shall provide a connectivity manufacturer 25 year extended warranty covering the fiber optic backbone cabling system.

B. General: The Contractor directly responsible for this work shall be a Premise Distribution who is, and who has been, regularly engaged in the providing and installation of commercial and industrial telecommunications wiring systems of this type and size for at least the immediate past five years. Any sub-contractor, who will assist the BDS contractor in performance of this work, shall have the same training and certification as the BDS contractor.

C. Certification: The contractor's Project Manager shall possess a current BICSI Registered Communications Distribution Designer (RCDD) certificate. All shop drawings submitted by the contractor shall bear the RCDD's seal.

D. Experience: The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical fiber premise distribution systems and have personnel who are adequately trained in the used of such tools and equipment.

1.5 SUBMITTALS

A. General: Submittals shall include manufactures cut sheets for all proposed equipment including, but not limited to, the following:

1. All wire and cable.
2. All connectors and required tooling.
3. All termination system components for each cable type.
4. All MDF/IDF, MDA eq frame types, hardware and LAN equipment if part of this project.
5. All “J” hooks and cable suspension components.
6. All grounding system components.
7. All FDC's, all miscellaneous IDF rack equipment, and backboards.
8. Detailed test procedure including all tests to be conducted and list of eq used.

1.6 SPECIAL REQUIREMENTS FOR CABLE ROUTING AND INSTALLATION

A. Ceiling Spaces: The majority of wiring in this building will be installed above ceilings. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC) article 800. All cabling shall bare CMP/OFNP and/or appropriate markings for the environment in which they are installed.

B. Cable Pathway: The contractor shall adhere to the manufacturers' requirements for bending radius and pulling tension of all cables.

C. Protection: Sealing of openings between floors, through rated fire and smoke walls, existing or created by this contractor for cable pass through shall be the responsibility of the contractor. Sealing material and application of this material shall be accomplished in such a manner acceptable to the local fire and building authorities having jurisdiction over this work. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of this contractor's work. Any openings created by or for this contractor and left unused shall also be sealed as part of this work.

D. Damage: The contractor shall be responsible for any damage to any surfaces or work disrupted as a result of his work. Repair of surfaces including painting and ceiling tile replacement shall be included as part of this contract.

1.7 WORK EXTERNAL TO THE BUILDING

A. General: Any work external to the confines of this building as shown on the drawings shall be governed by the provisions of this specification.

PART 2 - PRODUCTS

2.1 CABLE SUPPORT SYSTEM

A. General – When required, Fiber Optic cables in innerducts shall be suspended by prefabricated J-hooks specifically designed for data cabling. J-hooks shall be permanently attached to the structure using drop wire/rod suspension, beam flange, or wall mount. The J-hooks shall feature a wide base loop with smooth curves to eliminate snag potential and cable deformation.

B. Listings: J-hooks shall be in accordance with NEC, EIA/TIA requirements for structured cabling systems. All cable supports shall be U.L. listed.

C. Design selection: B-Line cable hook system or approved equal.

2.2 FIBER OPTIC CABLING

A. Approved Manufacturers:

1. Corning, Basis of Design (BOD)

a. Corning Interlocking Armored (RISER/Plenum)
b. Corning loose Tube

B. General: Multi-mode and single-mode fiber optic cabling shall be provided between the MDF and TR's. Fiber optic cables shall be tight buffered indoor/outdoor rate and UL listed OFNR or OFNP. Cables installed in plenum spaces shall be UL listed OFNP only. Backbone fiber optic strands shall be optimized for Laser/ VCSEL transmission equipment. Fiber strands shall be capable of supporting 10 Gigabit Ethernet transmissions up to 300 meters @ 850nm. Warranty all premise fiber cable as part of the 25 year extended warranty.

C. Backbone OM-4 Multimode cable construction:

1. Number of fibers: as shown on the drawings
2. Core/Cladding: 50 micron/125 micron.
3. Buffering: 900 micron
4. Attenuation: 3.0 dB-Km at 850 nanometers, 1.0 dB-Km at 1300 nanometers.
5. Minimum OFL bandwidth: 3500 MHz-Km @ 850nm, 500 MHz-Km @ 1300nm
7. Minimum laser bandwidth: 4700 MHz-Km @ 850nm, 500 MHz-Km @ 1300nm.
8. Sheath construction: Non-metallic
9. Design Selection (Indoor/outdoor)
10. Color; Aqua

D. Backbone OS-2 Single mode cable construction:

1. Number of fibers: as shown on the drawings
2. Core/Cladding: 8.3 micron/125 micron.
3. Buffering: 900 micron
4. Attenuation: .5 dB-Km at 1310 nanometers, .5 dB-Km at 1550 nanometers.
5. Minimum laser bandwidth: xxx MHz-Km @ 1310nm, 10,000 MHz-Km @ 1550nm.
6. Sheath construction: Non-metallic
7. Design Selection (Indoor/outdoor)
8. Color; Yellow

2.3 INNERDUCT

A. General: Fiber optic backbone cabling shall be installed with innerduct for protection of fiber stands in shared use pathways as designated on contract drawings. Innerduct shall be pre-threaded with a pull tape. Per NEC Article 770-51 innerduct installed in plenum and riser spaces shall be rated for these spaces. Per this specification all innerduct installed within the building in areas other than plenum and riser spaces, shall be riser rated. For backbone pathways between buildings and underground PE innerduct is permitted.

B. Design Selection: Maxcell or approved equal

2.4 FIBER OPTIC TERMINATION PANELS

A. Rack Mounted Panels: Fiber optic cabling shall be terminated in fiber distribution centers where indicated on the contract drawings and described herein. Provide blanking modules in all unused connection ports. FDC's shall be provided in quantities and configurations as shown on the drawings complete with multimode and single-mode duplex SC style coupler plates. All FDC's shall be provided with rack mounting hardware allowing the unit to be placed in a standard EIA 19" rack.

B. General: Provide blanking modules in all unused connection ports on the panels. All panels shall include strain relief points where fiber optic cable strength members shall be securely attached.

C. Labels: Labeling for fiber cabling shall be by IDF number, plus the color suffix designating which fiber is terminated. Die cut acetate labels or Kroy labels shall be considered acceptable the purpose.

D. Design Selection (Rack mount fiber panels): Panduit.

E. Design Selection (Adapter panels): Panduit.

F. Approved Equals: Corning

2.5 FIBER OPTIC CONNECTORS

A. Provide field installable, multimode SC type PC pre-polished connectors. Connectors shall be Glass-in-Ceramic, with a maximum loss of 0.5 dB. Multimode 50 micron fiber connectors shall be rated for 10 Gigabit support and aqua in color. Provide quantities so that all fiber optic cables are terminated.

B. Provide field installable, multimode SC type PC pre-polished connectors in the Data Center and MDA. Connectors shall be Glass-in-Ceramic, with a maximum loss of 0.5 dB. Multimode 50 micron fiber connectors shall be rated for 10 Gigabit support and aqua in color. Provide quantities so that all fiber optic cables are terminated.

C. Provide field installable, single mode SC type PC pre-polished connectors. Connectors shall be Glass-in-Ceramic, with a maximum loss of 0.5 dB. Single mode fiber connectors shall be rated for 10 Gigabit support and yellow in color. Provide quantities so that all fiber optic cables are terminated.

D. Design selection: Corning, Basis of Design (BOD).

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. Components of the premise distribution system shall be installed in a neat, workmanlike manner consistent with the best telephone and data practices.

B. Wiring color codes shall be strictly observed and terminations shall be uniform throughout the building.

C. Identification markings and systems shall be uniform.

3.2 SERVICE LOOPS

A. All cable runs shall contain service loops prior to the termination point. Provide a mininum of a 18 inch service loop in the ceiling above. Service loops at IDF's shall consist of a 10 foot coiled loop for site fiber located in the cable ladder above the equipment rack.

3.3 SUPPORT AND ROUTING OF CABLES

A. Fiber Optic cables used in this system are to be installed within ceiling spaces. Cables shall be routed through these spaces at right angles to electrical power circuits and supported only from the structure. Riser and tie cables shall be extended between IDF's utilizing conduit runs as shown on the drawing

B. Use of ceiling tiles, grid or hanger wires for support of BDS cables shall be prohibited.

C. The BDS system contractor shall install a complete system of supporting cable trays and other supporting hardware for this system as part of the BDS contract. All supporting hardware shall be submitted to the engineer for approval prior to installation.

D. The Contractor shall secure the cables to the wall to prevent horizontal movement of the cable (D-rings are acceptable). The Contractor shall secure the cables to the wall in non-deforming manner to prevent vertical movement of the cable, preferably with a wire mesh grip.

E. Where fiber optic cable passes through vertical riser spaces, sleeves, conduit or Telecommunications Rooms, secure fiber to wall vertically every 36 inches. Review fasteners, strain relief and routing with Architect and Owner.

F. The Contractor shall be responsible for verifying actual footages and distances identified on attached prints. Do NOT rely on scaled drawings.

G. Contractor to provide installed cable footage on As-Built Drawings.

3.4 FIRE AND SMOKE PARTITION PENETRATIONS

A. Conduit sleeves shall be provided as a means of routing cables between various communications rooms and multi floor buildings. Openings in sleeves and conduits used for the BDS system cables and those which remain (empty) spare shall be sealed with a U.L. approved fireproof, removable material.

B. Sleeves, which pass vertically from floor to floor, shall be sealed in a similar manner using an approved re-enterable system.

C. Additional penetrations through rated assemblies necessary for passage of BDS wiring shall be made using an approved method and permanently sealed after installation of cables.

3.5 TESTING OF FIBER OPTIC CABLE

A. Attenuation Testing: Contractor shall test each fiber strand of each cable. The owner reserves the right to have a representative present during all or a portion of the testing.

1. Fiber-Optic Backbone Cable: Each fiber in every backbone cable run shall be tested with a light source and optical power meter as manufactured by Ideal Industries, Fluke or pre-approved equal. Multimode fiber testing shall be I.A.W. TIA/EIA-526-14; method B and ANSI/TIA-568-C. Each multi-mode fiber shall be tested at both 850 and 1310nm. Maximum fiber strand attenuation shall be determined using the following link attenuation equation:
   Maximum attenuation= Connector attenuation + Cable attenuation + Splice attenuation
2. Maximum attenuation per component:
   Connector attenuation = 0.75dB/1 mated connector pair
   50 micron Cable insertion loss = 3.0 dB/km @ 850nm and 1.0dB/km @ 1300nm
   Single mode Cable insertion loss = 0.50 dB/km @ 1310 and 0.50 dB/km @1550nm
   Splice attenuation = 0.3dB/splice
3. Contractor shall calculate the acceptance values for each fiber strand based on the above criteria. The fiber certification report shall be submitted listing the acceptance dB value, the measured dB loss, and the dB margin of each measured fiber strand to the acceptance values.

B. Length Testing: Backbone lengths shall be verified with an OTDR or Light Source/Power Meter with length testing capacity.

1. Per this specification and design selection, maximum distance shall not exceed 300 meters to support LAN equipment operating at 850 nm.
2. Optical power meter and OTDR results shall be in the form of tester report print outs, hand written results will not be accepted. Photocopies of test results will not be accepted, only original signed print outs will be accepted. These results shall be submitted to the Engineer.
3. Obtain the cable manufacturer power meter test results for each real used on the project. Using the attached Optical Fiber Test Form record the readings and the manufacturer's reel number. Prior to completion of project, turn over the completed optical fiber test form, optical fiber cable reel ID tags and optical fiber cable manufacturer's test results.

C. Acceptance Testing:

1. Each terminated fiber strand in the horizontal or backbone infrastructure shall be tested individually as a permanent link. A fiber permanent link is defined as a length of individual fiber strand with a connector terminated on each end.
2. Testing for multimode shall be at 850 and 1300 nanometers. Total link insertion loss (dB) shall be within the specified link loss budget.
3. Tier 1 testing for each installed singlemode link shall be performed as an optical power insertion loss measurement, as defined by ANSI/TIA/EIA-526-7. Testing for singlemode shall be at 1310 and 1550 nanometers. Total link insertion loss (dB) shall be within the specified link loss budget.
4. Tier 2 testing, if required for each installed singlemode or multimode link, shall be performed as an OTDR measurement, as defined in TIA-TSB-140. We require Tier 2 testing on all fibers installed in the facility for future troubleshooting.
5. Multimode optical fiber attenuation shall be tested on all individual fibers of each cable segment using an LED light source and power meter to determine the

actual loss. These tests shall be performed at the 850nm and 1300nm windows in both directions. Test set up and performance shall be in accordance with ANSI/TIA/EIA-526-14A, Method B.

6. A reference power measurement shall be obtained by connecting one end of test jumper 1 to the light source and the other end to the power meter. After recording the reference power measurement, test jumper 1 shall be disconnected from the power meter without disturbing the light source and attached to the cable plant. The power meter shall be moved to the far end of the cable plant and attached to the cable plant with test jumper 2.
7. Readings must not be higher than the “Optimal Attenuation Loss.” The OAL will be calculated using the manufacturer’s factory certified test results, (db/km) converted to the actual installed lengths plus the manufacturer’s best published attenuation losses for the connector and/or splice installed on this project. (0.30+/-0.30 for Connectors and 0.10 for splices). The construction manager shall use the OAL for comparison with the end to end power loss test results prior to acceptance.
8. Test Results: Must be completed and turned over to the General Contractor prior to active equipment installation. Specific due dates for optical fiber will be established at pre-install meeting.

3.6 AS-BUILT DOCUMENTATION

A. As-built documentation shall be provided as part of the contract. As-built drawings shall be a complete set of AutoCAD Release 10 floor plans with all outlets shown and numbered as installed. The original project floor plan disks shall be obtained from the Engineer. All cable routings (trunk lines) and elevations of each MDF/IDF indicating outlet, tie and riser cable terminations shall be required. Termination sequences and a bill of materials for all equipment shall be in table form inserted on the associated floor plan sheet with that MDF/IDF elevation detail. All cable test results along with documented testing procedures shall be included in this information. All addendum information or project revisions resulting in drawing changes that occur during the construction period shall be documented and included in the as-built material. All required as-build documentation is mandatory and shall be required prior to project closeout.

3.7 SYSTEM WARRANTY

A. Cabling system wanrranty shall be for a complete channel configuration including cable, jacks, workstation cords, patch panels and patch cords. All cabling systems shall have warranty coverage by the same connectivity manufacturer. The cable manufacturer installed shall be specifically approved by the connectivity manufacturer for the 25 year warranty. Written documentation of the certification of system performance, along with guarantee provided under the warranty, shall be provided by the Contractor at the closeout of the project. Contractor shall provide warranty documents to the owner or owner’s representative at the end of the project.

END OF SECTION 27 13 23

SECTION 27 15 13
COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Copper Horizontal Cabling.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 SUBMITTALS

A. Provide product data from manufacturer’s specifications.

1.4 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specifications and drawings or not for a complete and operational system.

B. A single copper channel solution shall be installed for the entire project. Contractor shall install a Category 6 Plenum/Riser solution. The Contractor shall use a single manufacturer's copper or fiber solution (cables and components) for any given installation. The Contractor shall notify the Architect where a single product set solution is not possible.

1.5 HORIZONTAL ARCHITECTURE

A. TE/TrueNet’s outlets and connecting hardware (i.e., patch panels) are specified. The general architecture used for horizontal systems is an architecture that allows one patch panel (connecting hardware) with a direct patch cord (equipment cable) from the patch panel to the data networking equipment (common equipment).

B. In summary, all cabling will be terminated (punched down) at the patch panel and terminated (punched down) at the work area outlet. New installations will be wired to the 568B standard.

C. Rack patch panel count/fill rate is as follows: Racks with fiber patch panels (top position) will have no more than 3ea Cat6 48-port patch panels installed. Racks with no fiber patch panels will have no more than 4ea Cat6 48-port patch panels installed. 24-port patch panels are not to be used for data runs. In no case should the rack be configured to more than half full. 1 spare unpopulated 48-port patch panel per rack is required. Horizontal management must be installed between each patch panel. Vertical management must be installed between multiple rack installations and at each end.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Horizontal Copper Cable Manufacturer(s):

1. TE/Commscope TE 640Z1F-TLM2, Basis of Design (No substitutions) 4 pair/23 awg.

B. Approved Riser Cat 6A:

1. TE/Commscope TE 640Z1F-TLM2, Basis of Design (No substitutions) 4 pair/23 awg.

C. Approved Outside Cat 6 Cable:

1. TE/Commscope TE 1592 BLK C6A, Basis of Design (No substitutions) 4 pair/23 awg.

2.2 HORIZONTAL COPPER CABLE

A. 100 OHM Category 6 Balanced Twisted Pair UTP Cable:

1. The horizontal balanced twisted pair cable shall meet or exceed the Category 6A transmission characteristics per issue of ANSI/TIA/EIA-568-C.2.
2. Cable jacket shall be CMR or CMP rated (according to the space it occupies).
3. Jacket color shall be Yellow.
4. Security cameras jacket color shall be Orange.

PART 3 - EXECUTION

3.1 HORIZONTAL CABLES

A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.

B. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.

C. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-B maximum fill for the particular raceway type.

D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

E. Riser rated cable shall be installed in metallic conduit when installed in a plenum space.

F. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.

G. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.

H. Horizontal cable runs shall not exceed 295'. Contractor shall immediately notify general Contractor, Project Manager and Architect of any cable runs that exceed this installed length.

I. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

J. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

K. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

L. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the Contractor shall install appropriate carriers to support the cabling.

M. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.

N. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.2 document, manufacturer's recommendations and best industry practices.

O. All horizontal copper cables will be terminated as 568B per industry standards.

P. Leave a minimum of 12" of slack for twisted pair cables at the outlet. Cables shall be coiled in the in-wall box, surface-mount box or modular furniture raceway if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. Excess slack, 10' min, shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

Q. Cables shall be neatly bundled and dressed to their respective termination device. Each terminating device shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

R. Each cable shall be clearly labeled on the cable jacket behind the termination device at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.2 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 15 13

SECTION 27 15 43
COMMUNICATIONS FACEPLATES AND CONNECTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Faceplates and Connectors.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.4 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Copper Connectivity Manufacturer(s):

1. TE/Commscope,
2. Panduit

B. Approved Faceplate Manufacturer(s):

1. TE/Commscope,
2. Panduit

2.2 COPPER CONNECTIVITY

A. Voice/Data Jacks:

1. Category 6A, 8-Position, 8-Contact (8P8C) Modular Jack:

a. The connector module shall meet or exceed the Category 6A performance criteria per ANSI/TIA-568-C.2.
b. The eight-position connector module shall accommodate six-position modular plug modular cords without damage to either the cord or the module.
c. The connector module shall be designed for use at the work area (WA), communications room (TR) and/or equipment room (ER) without modification.
d. The connector module shall be available in both the T568A and T568B wiring configurations within the same module.
e. The connector module shall have an insulation displacement connection featuring insulation slicing of 22 to 24 AWG plastic-insulated solid copper conductors forming a gas-tight connection.
f. Icons shall be used if offered from the manufacturer.
g. Jack/Icon colors shall match faceplate. Security cameras shall be orange.

2.3 FACEPLATES

A. Faceplates:

1. The faceplate housing the connector modules shall have no visible mounting screws.
2. It shall be possible to install the connector modules in wall-mounted single- and dual-gang electrical boxes, utility poles and modular furniture (cubicle) access points using manufacturer-supplied faceplates and/or adapters.
3. The faceplate housing the connector modules shall have the option of being mounted on adapter boxes for surface mount installation.
4. The faceplate housing the connector modules shall have a labeling capability using built-in labeling windows, to facilitate outlet identification and ease network management.
5. The faceplate housing the connector modules shall provide flexibility in configuring multimedia workstation outlets that respond to present or future network needs such as audio, data, video, coaxial and optical fiber applications.
6. Color shall be white.

PART 3 - EXECUTION

3.1 COPPER CONNECTIVITY

A. 8-position, 8-contact (8P8C) modular jacks shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.

B. All copper terminations for this project shall follow the EIA/TIA 568-B standard.

C. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

3.2 FACEPLATES

A. Blank inserts shall be installed where ports are not used.

B. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation.

C. Faceplates shall be installed straight and level.

D. Faceplates shall be installed at the same heights as electrical faceplates.

E. The Contractor shall install blank outlet covers in any unused outlet of all faceplates.

F. Wall Phone Installations:

1. Furnish and install the wall phone faceplate according to the manufacturer's instructions. Each wall phone shall be terminated on its own dedicated 8P8C outlet where indicated on the drawings. No special panel shall be installed for wall phones.

3.3 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 15 43

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SECTION 27 16 19
COMMUNICATIONS PATCH CORDS AND WORKSTATION CORDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Patch Cords and Workstation Cords.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.4 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Copper Patch Cord Manufacturer(s):

1. TE/Commscope, 640 -23 AWG.
2. Panduit

B. Approved Fiber Patch Cord Manufacturer(s):

1. TE/Commscope, LC TO LC

2.2 COPPER PATCH CORDS/WORKSTATION CORDS

A. Category 6 Patch Cords/Workstation Cords:

1. The Category 6A patch cord shall be 4-pair, with 24 AWG stranded copper conductors and 8-position modular plug.
2. The Category 6A modular cord cable shall be UL Listed as Type CMR.
3. The Category 6A patch cord shall meet or exceed the requirements of ANSI/TIA-568-C.2.
4. Provide the following numbers of patch cables:

a.	25,	(30')	Cat 6 patch cord color for data shall be:	Yellow
b.	200,	(11')	Cat 6 patch cord color for data shall be:	Yellow
c.	200,	(7')	Cat 6 patch cord color for data shall be:	Yellow
d.	50,	(7')	Cat 6 patch cord color for CATV shall be:	Blue
e.	100,	(7')	Cat 6 patch cord color for WAP shall be:	Orange
f.	50,	(7')	Cat 6 patch cord color for SEC shall be:	White

2.3 FIBER PATCH CORDS / WORKSTATION CORDS

A. Multimode Fiber Patch Cords:

1. 10Gb 50/125-Micron 850nm Laser Optimized Multimode, LOMMM Fiber Patch Cord/Workstation Cord (OM-4)

a. The 50/125-micron fiber used in the multimode fiber patch cord/station cord shall have a maximum attenuation of 3.0dB/km@850nm and 1.0dB/km @1300nm.
b. The 50/125-micron 850nm laser optimized multimode fiber patch cord/station cord shall meet or exceed the requirements of ANSI/TIA-568-C.3.
c. The multimode fiber cord assembly shall be dual zip jacketed.

2. Provide the following numbers of patch cables:

a. 20 (2M) LC to LC fiber OM-4 MM patch cord; Aqua
b. 20 (3M) LC to LC fiber OM-4 MM patch cord; Aqua.
c. 10 (5M) LC to LC fiber OM-4 MM patch cord; Aqua.

PART 3 - EXECUTION

3.1 COPPER PATCH CORDS/WORKSTATION CORDS

A. Copper patch cords/workstation cords shall be installed as per the drawing requirements and as specified by the manufacturer's installation guidelines.

1. Workstation or end user patch cords shall be (7') long unless longer is required.

B. Coordinate the station and modular Work Area patch cords with the Furniture Contractors so as to not damage any equipment and leave the cords in a user-accessible location.

C. Install the Equipment Room patch cords with the Owner so as not to damage any equipment and leave the cords in a user-accessible location. Do not prohibit the installation of any rack-mounted equipment.

2.4 FIBER PATCH CORDS

A. Fiber patch cords/workstation cords shall be installed as per the drawing requirements and as specified by the manufacturer's installation guidelines.

2.5 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 16 19

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SECTION 27 21 33
DATA COMMUNICATIONS WIRELESS ACCESS POINTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Copper Horizontal Cabling.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 SUBMITTALS

A. Provide product data from manufacturer’s specifications.

1.4 WORK INCLUDED

A. It is the intent of this document and associated drawings to provide a 802.11 a/b/g/n wireless Ethernet data system and provide coverage for the entire facility. Any discrepancies or concerns shall be brought to the attention of the General Contractor and project engineer.

B. A single port surface-mount or recessed box shall be specified at locations for the typical wireless access point device. (installed by Division 27)

C. Wireless access points and their associated mounting hardware are provided and installed by the Owner.

D. The contractor shall price the installation of the cabling infrastructure to support the Wireless network, and the installation of the Wireless devices limited to the structured cabling systems and installation of the mounting hardware.

1.4 UNIT PRICING

A. Submit unit price for the installation of additional wireless access points to include: single data copper cables up to 295 feet or 90 meters, surface mount box, one port, three blank

modules, one 25' patch cord and data cable modules. Estimate an appropriate amount of cables, ports, supports and consumables for one wireless access point.

B. Submit unit price for the installation of an Owner-furnished Cisco Aironet AP1140 Access Point Ceiling/Wall Mount Bracket Kit. The Owner shall provide the bracket kit. The Contractor shall provide labor and consumable materials to install the bracket. The Contractor shall install, attach and/or affix the Access Point to the bracket according to the manufacturer's instructions and to the Owner's reasonable satisfaction, which shall include labeling the Access Point with a machine generated label sufficient to uniquely identify the Access Point without any tools from a vantage point on the floor. In cases where the Access Point is located higher than 12' above finished floor, the Contractor shall provide a drawing showing a plan view of the room identifying the Access Points and each unique label.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Refer to Section 27 00 00 - Communications for Materials to be provided by Contractor.

B. Owner shall provide the Wireless Access Mounting and Bracket hardware not covered by 27 00 00 Communications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate final placement and mounting procedures of wireless access points and outlet locations with Owner, Architect, General Contractor and Owner's Representative.

B. The Contractor shall install, attach and/or affix the Access Point to the bracket according to the manufacturer's instructions and to the Owner's reasonable satisfaction, which shall include labeling the Access Point with a machine generated label sufficient to uniquely identify the Access Point without any tools from a vantage point on the floor. In cases where the Access Point is located higher than 12' above finished floor, the Contractor shall provide a CAD drawing showing a plan view of the room identifying the Access Points and each unique label.

C. The contractor to provide labor and consumable materials to install the bracket.

D. The contractor shall connect and test access point to the network cabling with a Cat 6A patch cable.

END OF SECTION 27 21 33

SECTION 27 32 23
ELEVATOR TELEPHONES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Copper Horizontal Cabling.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.4 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

B. Contractor shall install a single voice cable to the elevator machine room for use by the elevator installers per Section 27 15 13 - Communications Copper Horizontal Cabling.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Refer to all of Division 27 for product and process requirements.

B. Refer to Section 14 20 00 Elevators for connection information.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install the cable to the elevator machine room and in proximity to the elevator equipment.

B. The cable shall be installed within conduit or solid raceway within the elevator machine room. Coordinate pathway and outlet installation with the elevator contractor.

C. Terminate the cable with a single voice module for testing and certification.

D. Leave a 15’ foot patch cable to be installed by the elevator contractor.

END OF SECTION 27 32 23

SECTION 27 41 52
AUDITORIUM SOUND SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Special Conditions and Division-1 Specification sections, apply to work specified in this section.

1.2 SUMMARY

A. This section covers the auditorium sound and video system and the sound systems in the drama lab, dance studio, band room, and vocal room.

1.3 GENERAL REQUIREMENTS

A. This project is the provision and installation of new systems within a new venue. All bidders shall fully inform themselves of the conditions under which the work is to be performed. No additional compensation or time extension will be given for conditions of which bidder could have been fully aware prior to bid

B. The systems and all components shall conform to all applicable code requirements and shall be furnished and installed in conformance to industry standards of operation and practices. All materials, arrangements, and procedures shall comply with applicable code requirements.

C. The contractor is responsible to ensure that the system and all system components, fixtures, equipment, devices, wire, terminations, field assemblies (including custom assemblies) etc. pass all required inspections by the local authority having jurisdiction.

D. Any errors, omissions, or ambiguities found in these documents do not relieve the contractor from the responsibility of providing all items necessary for complete, safe, fully functional systems. Any errors, omissions, or ambiguities shall be brought to the attention of the Architect/Engineer of Record, Construction Manager, Owner, and/or Theater Consultant for clarification.

E. The drawings and specification when taken together communicate the design intent of the system. The contractor is responsible for all engineering, procedures, drawings, equipment, material, means and methods, and contract administration necessary to fully and completely furnish and install the system contemplated by these documents

F. Anything shown on the drawings or included in this specification shall be considered as part of both documents.

G. Any item of equipment or hardware that may not be specifically shown on the drawings or specified herein but required for proper system operation or installation shall be furnished and installed and be of the highest quality available.

H. The contractor shall assume full responsibility for a complete operating installation, in the required location, in accordance with the contract documents.

1.4 SCOPE OF WORK

A. This section requires the fabrication, furnishing, delivery, installation, testing of the audio and video systems, equalization of the audio system, and programing of the control systems as indicated on the drawings and specified herein.

B. Provide a professional quality, complete and properly operating system in every respect and detail.

C. Employ the most current best standard practices for all aspects of work.

D. Examine the plans in detail to familiarize with the scope of the work.

E. Provide all materials, equipment, procedures, labor, tools, scaffolds, and incidentals necessary to the scope of work.

F. Any item of equipment or hardware that may not be specifically shown on the drawings or specified herein but required for proper system operation or installation shall be furnished and installed and be of the highest quality available.

G. Provide all necessary equipment for the complete sound and video system installation as shown on the drawings and specified herein.

H. Provide speaker, plates, panels, millwork, enclosures, baffles, grille cloth, and all other items under this contract in a manner and color as approved by the architect.

I. No changes will be allowed for any issue that could have or should have been known at the time of bid. This includes but is not limited to discontinued products.

J. The contractor is solely responsible for meeting all codes and regulations and for the complete code compliance of the finished system.

K. The contractor acknowledges that the consultants' opinion is final.

L. Coordinate fully with the electrical contractor.

1.5 WORK INCLUDED: The work of this section includes, but is not limited to the following:

A. Coordinate the system conduit and device locations with the electrical contractor.

B. Deliver to the job site, and coordinate the installation of, the specialty equipment with the electrical contractor.

C. Furnish, install, and terminate all wire.

D. Furnish and install all system devices.

E. Provide all required shop drawings and submittals.

F. Provide system manuals.

G. Provide system warranty.

H. Provide system training.

I. Procure of all required permits.

J. Furnish all non-standard back boxes shown on the electrical drawings to the electrical contractor.

K. Furnish sequencing panel board to the electrical contractor.

L. Provide all DSP programing, control system programing, system tuning and complete configuration of all components.

M. Provide control system programming in a manner that meets all the owner's needs and request in terms of function and usability. This includes owner suggested modifications post system checkout.
   1. Provide Crestron source code
   2. Provide Crestron assembled installed code
   3. Crestron control pages must be controllable via an iPad
   4. In addition to the touch panel(s), provide both executable and web-based x-panel interfaces

N. Provide all mounting and attachments of all speakers, projectors, projection screens, displays, TVS, and equipment unless specifically indicated otherwise.

O. Coordinate all wireless microphone frequencies.

P. Equipment Power
   1. Provide power distribution within all equipment racks.
      a. Furnish and install a jbox in the top of each rack for the electrical contractor to "make up" to.
      b. Provide power strips, power outlet boxes, internal rack wiring and everything necessary to power up all rack equipment.
   2. Provide power cables for all portable racks and equipment.

Q. Other requirements.
   1. All RJ45 jacks and portable cables shall be color coded according to function.
   2. All RJ45 portable cable shall be heavy duty service type – Wireworks TacCat6 or equal.
   3. All RJ45 jacks shall be Nuetrik EtherCON.

1.6 RELATED WORK NOT INCLUDED

A. The following items of work, if required, are included in other sections and must be reviewed by the sound contractor for impact on this work:
   1. Necessary conduit and raceway runs.
   2. Stage flooring.
   3. Theatrical stage lighting and electrical connections, electrical contractor supplied junction and back boxes, wiring to power sources, and wiring to all other electrically powered devices.

4. Front of house catwalks.

1.7 CONTRACTOR'S QUALIFICATIONS

A. Only qualified contractors shall be used.

B. The work of this section will be contracted to a single firm, referred to as the contractor.

C. The contractor shall be a systems contractor who regularly engages in the furnishing, installation and servicing of professional systems of similar nature, size, scope and complexity to that contemplated by this specification. The contractor shall have done so for a period of not less than five years preceding the bid date.

D. The contractor shall have maintained for the five years preceding the bid date, a suitably staffed and equipped service organization which has continuously offered maintenance and repair services for systems of the nature, size, scope and complexity to that contemplated by this specification.

E. All liens must be satisfied for a minimum of five years and have no outstanding liens filed against them.

F. Must be licensed and insured.

G. Must be a factory authorized dealer for all major system components:
1. Amps
2. Control system
3. Digital signal processor
4. Mixing console
5. Speakers
6. Video projector(s)
7. Wireless microphones

H. The contractor shall demonstrate to the satisfaction of the owner, through exhibits presented with his bid, that the sound contractor has a history to indicate the following:
1. Statement of company history. Include a breakdown by percentage of gross sales of all business activities the contractor is involved in for each of the last 5 years (e.g. system installation = 30%, box sales = 40%, equipment rentals = 20%, design and other professional services = 10%, etc).
2. Previous experience: Provide a list of four installations of the type and size contemplated by these specifications, currently in use as originally installed, in which a theatre / system consultant was involved, completed in the last 5 years and the following information regarding each installations:
    a. Name and address of each installation facility.
    b. Facility owner and telephone number.
    c. Name, address, and phone number of a person regularly employed by the owner, who is familiar with the operation of the systems and who has no connection or business connections with the contractor except as the contractor shall fully disclose
    d. Name, address, and phone number of the theatre / system consultant, along with the names of all the consultant’s personal directly involved.
    e. System shop drawing - These will be returned if the contractor provides a call tag or return postage.

f. Owner's manual drawing - These will be returned if the contractor provides a call tag or return postage.
g. System as-built drawings drawing - These will be returned if the contractor provides a call tag or return postage.
h. List of contractors personal involved with each persons responsibility on the project.
i. Name, address and phone number of the general contractor, along with the names of all key GC personal directly involved.
j. Name address and phone number of the electrical contractor, along with the names of all key EC personal directly involved.

3. Statement of current company capabilities and ownership.
4. Key Personnel: For each of the key personnel listed below; Include individual's name, title, and number of continuous years of service to contractor. Include a biography detailing industry experience, and role within organization (include only full-time/regular staff employees; not independent contractor, freelance, or temporary positions). List all industry certifications held, training courses attended, and continuing education credits, including dates of attendance. List recently completed projects, scope of project, and completion dates.
   a. Project Manager
   b. Senior Technician
   c. Service Manager
5. Other Department Staff – Include size of staff, and experience of each staff member.
6. Replacement and Spare Parts Inventory – Provide detailed list of primary replacement parts, components, and spares typically held in inventory.
7. Test Equipment and Physical Plant – Include an inventory of all test facility equipment owned and used regularly by the Service Department. Provide description of physical plant and space utilization.
8. Copies of all business and professional licenses and insurance certificates.
9. Without prejudice to other AV system sub-contractor desiring to be qualified, the following are considered qualified:

BCI Integrated Solutions
9501 Princess Palm Avenue
Tampa, FL 33619
(813) 249-1020
Michael Fraioli

Peerson Audio, Inc.
1235 Park Lane South
Jupiter, Fl 33458.
(561) 741-8720
Doug Lettsome

Pro Sound & Video – A Solotech Company
1375 N.E. 123rd Street
Miami, FL 33161
(305) 891-1000
Rick Scharmann

PART 2 - PRODUCTS

2.1 ALTERNATES

A. In no case will equipment or materials of lesser design or workmanship be acceptable. Only those materials and equipment listed in this specification will be considered unless prior approval is sought and received.

B. Substitutions: When a specific piece of equipment specified has been discontinued and/or replaced by a new model, substitution will be acceptable when:
   1. Submission of complete data on the new model or substitute has been approved by the owner prior to equipment acquisition. Data shall include list pricing for specified and replacement equipment.
   2. Substitute equipment or the replacement of rejected equipment shall be at the sole expense of the sound contractor.
   3. After submittals have been approved there will be no cost to the owner for any required replacement equipment under any circumstances.

C. Should the contractor proposed and receive approval for the use of alternative wire and cable which requires additional conduit, the contractor will be solely responsible for the installation of such conduit.

2.2 GENERAL REQUIREMENTS

A. The major items of equipment shall be furnished in the quantity as on the drawings and the quantity as specified herein.

B. When documents list several acceptable manufacturers for a particular item of equipment, more than one of which is to be provided, the sound contractor shall supply all of those similar items of equipment from one manufacturer.

C. All equipment, where applicable standards have been established, shall be listed by a nationally recognized testing labs and must bear a compliance label with delivered to the job.

D. If so required by the local authority having jurisdiction, anything not arriving at the job bearing a compliance label from a nationally recognized testing lab shall be field inspected and labeled by such a testing lab. This extends to all field assemblies.

E. The performance of all equipment must meet the most recently published manufacture’s data sheet.

F. Provide all power supplies, POE power injectors, rack power distribution, power cabling and related equipment required.

G. Provide all software, drivers, etc..
   1. Shure Wireless Work Bench
   2. DSP setup / editor
   3. Yamaha StageMix App
   4. Yamaha console editor
   5. Dante controller software
   6. Amp control software

7. Crestron source code
8. Crestron assembled installed code
9. Crestron control pages must be controllable via an iPad
10. Crestron control: in addition to the touch panel, provide both executable and web-based x-panel interfaces
11. All others as required

H. The system has been engineered and coordinated to a very high standard. If alternates are not listed in the equipment list below there are no known equals

I. Provide all equipment identified in the contract drawings.

J. Provide the follow equipment in the quantities shown in the contract drawings:
1. LGT-2: Local Control Light
   a. Dialight 557 Series red LED panel mount indicator light with voltage determined by DSP logic output.
2. SWT-2: Local Control Switch
   a. Schurter MSM 22 Series, non-illuminated, momentary action, micro switch

K. Backboxes and Enclosures: Furnish to the electrical contractor all specialty backboxes and enclosures required See the electrical device location drawings, system conduit rises and symbol key for types and quantities required.
1. CMP1 = Whirlwind black powder coated surface mount 12x12x6 backbox with either Whirlwind WFS flush mount wall frame + custom panel or Whirlwind WFS surface mount wall frame + custom panel. Equal Wireworks Guardian Panel Mounts + custom panels will be accepted.
2. CMP2 = Whirlwind black powder coated surface mount 8x8x6 backbox with either Whirlwind WFS flush mount wall frame + custom panel or Whirlwind WFS surface mount wall frame + custom panel. Equal Wireworks Guardian Panel Mounts + custom panels will be accepted.
3. ICSS = backbox for Clear-Com KB-701 / kb-702 INTERCOM speaker station.
4. SJ1P = Custom assembly consisting of a FSR black SWMB-1 single gang surface mount backbox with a TMB CLAMP1 “C-Clamp” installed on the bottom of the box.
5. CS = Ceiling speaker. Type varies by location.
6. PS = Projection Screen. Draper Motorized Paragon V Matte White XT1000VB Front Projection Surface. 16:10 Aspect Ration. 307” diagonal. Viewable image area – 13’-6” Tall by 21’-8” wide. 110v. Add low voltage controls LVC-IV. Extra 96” black drop at top.
7. RS 1 = AV Rack. Middle Atlantic Products WR-44-42. Include solid front door.
8. RS 2 = AV Rack. Middle Atlantic Products WR-44-42. Include solid front door.
9. SJ1P = Pipe mounted speaker jack.

L. Panels: All panels are made of 1/8" thick Aluminum plate, brushed anodized black and sealed. All controls and connectors will have engraved labels. The minimum allowable label size is 1/8"s. All labels will be back filled with white paint. All connectors are mounted with machine hardware. All panel layouts and labels must be submitted and approved prior to construction, the panels shown in the drawings are typical only.

M. Microphone Receptacles: The above general requirements for panels apply to the construction of Microphone Receptacles as well. See the contract drawings for quantity and type required.

N. Monitor Speaker Receptacles: The above general requirements for panels apply to the construction of Monitor Speaker Receptacles as well. See the contract drawings for quantity and type required.

O. Tie Line Receptacles: The above general requirements for panels apply to the construction of Tie Line Receptacles as well. See the contract drawings for quantity and type required.

P. Intercom Connection Receptacles: The above general requirements for panels apply to the construction of Intercom Connection Receptacles as well. See contract drawings for quantities and types required. All 6 pin connectors must be Switchcraft compatible.

Q. Custom panels: See drawings for required components.

R. Connectors:
1. All XLR cable connectors are Neutrik “XX” series, black bodies, and silver contacts unless otherwise indicated.
2. All XLR chassis connectors are Neutrik “DLX” series, black bodies and silver contacts unless otherwise indicated.
3. All 6 pin XLR connectors for intercom must be “Switchcraft compatible”
   a. Six pix chassis mount male connector = Neutrik NC6MSD-L-1
4. All D-shaped RJ45 jacks are Neutrik etherCON CAT6A, shielded, feedthrough, black housing
5. All RJ45 plugs are Neutrik etherCON CAT6A, black bodies = Neutrik NE8MX6-B or NE8MX6-B-T depending on conductor size.
   a. Install Neutrik XXR-* color coding rings on all cable mount plugs. Ring color shall match corresponding jack color.
6. All speaker cable connectors are Neutrik speakON series.
   a. All four pole chassis mount connectors are Neutrik NL4MP-UC
   b. All four pole cable mount connectors are Neutrik NL4FC
   c. All eight pole chassis mount connectors are Neutrik NLTMP-BAG
   d. All eight pole cable mount connectors are Neutrik NLT8FX-BAG
7. All RCA chassis connectors are Neutrik D-shaped housing, black chrome bodies, solder tabs
   a. Stereo left = white isolation washer Neutrik NF2D-B-9
   b. Stereo right = red isolation washer Neutrik NF2D-B-2
8. All 75□ BNC female chassis connectors for analog video, all SDI formats, and coax digital audio are Neutrik NBB75DFIX (isolated, UHD, feed through, antraloy plated, D-shape) or Canare BCJ-JRUDBK.
9. All user accessible 75□ BNC male cable mount connectors are Neutrik rearTWIST UHD series where compatible coax cables are present.
   a. Belden 4731RBUHD3 for Belden 7731WB
   b. Neutrik NBNC75ZV14X for Belden 4794R and Canare L5.5CUHD
   c. Neutrik NBNC75BTU11 for Belden 4694F
10. All 75□ BNC male cable mount connectors that are not user accessible – use cable manufacture’s matching BNC connector.
11. All 50□ BNC female chassis connectors for antenna jacks are Ace Backstage model C-25121 isolated feed through BNC connector mounted in black plastic universal D sized adaptor plate.
12. All 50□ BNC male cable mount connectors – use cable manufacture’s matching BNC connector.
13. All F type female chassis connectors are Ace Backstage model C-25104 isolated feed through F type connector mounted in black plastic universal D size adaptor plate.
14. All F type male cable mount connectors – use cable manufacture’s matching F connector.
15. All HDMI chassis mount pass through connectors are Neutrik NAHDMI-W-B
16. DisplayPort chassis mount pass through connectors are either Extron MAAP black DisplayPort female to female pigtail modules part # 70-676-12 or Crestron MP-WP162-B (this is a single gang “Decora” size / style device) depending on size.

17. All USB chassis mount pass through connectors are Neutrik NAUSB3-B
18. All 1/4" phone jacks are Neutrik NJ3FP6C-BAG (3 pole, metal housing, silver contacts)

S. System Wire:
1. All wiring in a conduit, where the conduit is located in the slab or on grade, must be rated for wet location.
2. Where West Penn Wire part numbers are specified, equivalents by Belden will be approved provided no change in conduit size is required.
3. Where Belden part numbers are specified, equivalents by West Penn Wire will be approved provided no change in conduit size is required.
4. All low Z speaker runs and all monitor / effects speaker receptacles:
   a. Wire enclosed in conduit, racks, or speaker enclosures – twisted pairs of 10 A.W.G. THWN
   b. Wire enclosed in conduit; where the conduit is not in a wet location, racks, speaker enclosures - twisted pairs of 10 A.W.G. THWN
   c. Wire not enclosed in conduit or racks, service type cables, connection jumpers, and patch cables:
      1) Two conductor = 12/2 SJO
      2) Four conductor = Whirlwind W12/4
      3) Eight conductor = Whirlwind W13/8
   d. Wire both pairs / all four poles of all four pole Neutrik speakON jacks from field jacks back to the amp racks/ amp outputs / patchabay jacks.
   e. Wire all four pairs / all eight poles of all eight pole Neutrik speakON jacks from field jacks back to the amp rack / amp outputs / patchabay jacks.
5. All 70 volt speakers, volume controls, priority attenuators, priority attenuator relays:
   a. Wire enclosed in conduit; where the conduit is in a wet location - West Penn Wire AQC 225
   b. Wire enclosed in conduit; where the conduit is not in a wet location, racks, speaker enclosures - West Penn Wire 225
   c. Wire not enclosed in conduit or racks, service type cables, connection jumpers, and patch cables – Whirlwind W16GA
6. All mic, analog line, and DC signaling:
   a. Wire enclosed in conduit; where the conduit is in a wet location – Belden 5500F1 or West Penn Wire AQC 291
   b. Wire enclosed in conduit; where the conduit is not in a wet location, and racks – West Penn Wire 291
   c. Wire not enclosed in conduit or racks, service type cables, connection jumpers, and patch cables – Whirlwind W1192A-BK Star Quad
7. All intercom:
   a. Wire enclosed in conduit; where the conduit is in a wet location - Belden 5300F1 + an additional green with yellow strip 12 A.W.G. THWN wire or West Penn Wire AQC 293 + an additional green with yellow strip 12 A.W.G. THWN wire.
   b. Wire enclosed in conduit; where the conduit is not in a wet location, and racks – West Penn Wire 293 + an additional green with yellow strip 12 A.W.G. THWN wire.
   c. The additional 12 A.W.G THWN wire shall be connected in parallel with the drain wire of the shielded twisted pair cable.
   d. Wire not enclosed in conduit or racks, service type cables, connection jumpers, and patch cables – Whirlwind W1192A-BK Star Quad
8. All twisted pair AES/EBU:
   a. Wire enclosed in conduit; where the conduit is not in a wet location, and racks - West Penn DA2401.
   b. Wire not enclosed in conduit or racks, service type cables, connection jumpers, and patch cables – Whirlwind W1800F

9. All Dante, AV control network, CAT6A tie line, Ethernet, One-Link, RDL Twisted Pair, TCP/IP, and other category type cabling not specified elsewhere = CAT6A F/UTP:
    a. Wire enclosed in conduit; where the conduit is in a wet location - West Penn Wire 4246AFIO
    b. Wire enclosed in conduit; where the conduit is not in a wet location, and racks – West Penn Wire 4246AF
    c. Wire not enclosed in conduit or racks, service type cables, connection jumpers – Whirlwind ENC6ASE shielded CAT6A cable with Neutrik etherCON CAT6A connectors or TMB Proplex CAT6A Extended length S/FTP
10. ALS transmitter antenna = RG58 50□:
    a. Wire enclosed in conduit; where the conduit is in a wet location - Belden 7808WB
    b. Wire enclosed in conduit; where the conduit is not in a wet location, and racks – Belden 7807R
    c. Wire not enclosed in conduit or racks, service type cables, connection jumpers, and patch cables – Belden 7807R
11. Wireless microphone antenna = RG8 50□:
    a. Wire enclosed in conduit; where the conduit is in a wet location - Belden 7810WB
    b. Wire enclosed in conduit; where the conduit is not in a wet location, and racks – Belden 7810A
    c. Wire not enclosed in conduit or racks, service type cables, connection jumpers, and patch cables – Belden 7810A
12. Analog video, all SDI formats, and coax digital audio = 75□:
    a. Wire enclosed in conduit; where the conduit is in a wet location - Belden 7731RW
    b. Wire enclosed in conduit; where the conduit is not in a wet location, and racks – Belden 4731R
    c. Wire not enclosed in conduit or racks, service type cables, connection jumpers, and patch cables – Belden 4694F
13. Modulated RF TV distribution = RG6 75□:
    a. Wire enclosed in conduit; where the conduit is in a wet location – West Penn Wire AQC806
    b. Wire enclosed in conduit; where the conduit is not in a wet location, and racks – West Penn Wire 806
    c. Wire not enclosed in conduit or racks, service type cables, connection jumpers, and patch cables – West Penn Wire 806
14. HDMI:
    a. Wire enclosed in conduit; where the conduit is not in a wet location, and racks - Extron HDMI Ultra Series
    b. Wire not enclosed in conduit or racks, service type cables, connection jumpers, and patch cables - Extron HDMI Ultra Series
15. Crestron DM
    a. Wire enclosed in conduit; where the conduit is in a wet location - consult Crestron
    b. Wire enclosed in conduit; where the conduit is not in a wet location, and racks – Crestron DM-CBL-ULTRA-NP
    c. Wire not enclosed in conduit or racks, service type cables, connection jumpers, and patch cables – Crestron DM-CBL-ULTRA-PC

T. Internal Rack Power Wiring:
1. Provide all power wiring, devices, hardware, receptacles, etc. as required to power wall equipment within each rack.
2. Provide a junction box located at the top of the rack for connection to circuiting by the electrical contractor.
3. Provide power cables for all portable racks.

U. Power Sequencing Panel Board

1. Furnish to the electrical contractor for installation the following LynTec Power Sequencing Panel Board:
   a. Model RPC 341 panel with required control cards
   b. SGX20-10 surge protection “side car”

V. 125 amp main breaker
   a. Provide motorized 20A single pole, motorized 20A two pole, motorized 20A three pole, motorized 30A single pole, motorized 30A two pole, motorized 30A three pole, standard 20A single pole, standard 20A two pole, standard 20A three pole, standard 30A single pole, standard 30A two pole, and standard 30A three pole breakers as indicated on electrical panel schedule.
   b. See drawings for circuit details.

W. Portable Equipment: Provide the following portable equipment that is not shown on the contract drawings:
1. Show monitor mic: Mount a Shure Beat 87A from the rear wall pointed toward the stage and wired to the ALS mic jack. This is a permanent installation and will require a custom assembly of mic mounting hardware. Typically a mounting flange with a small boom arm will be required to place the mic out into the room and rigidly hold it in position. Fishing line of other similar methods will not be accepted.
2. Mixing Console Accessories:
   a. LED console gooseneck lamps
   b. Dust cover
3. Assisted Listening System Components:
   a. 36 @ Listen Technologies model LR-5200-072 advanced intelligent DSP RF receiver
   b. 36 @ Listen Technologies model LA-401 universal ear speaker
   c. 12 @ Listen Technologies model LA-430 intelligent ear phone / neck loop lanyard
   d. 2 @ Listen Technologies model LA-303 multi-lingual assistive listening notification sign
   e. 36 @ Listen Technologies model LA-365 replacement rechargeable Li-Ion battery
   f. 3 @ Listen Technologies model LA-381 intelligent 12-unit charging tray
   g. 1 @ Listen Technologies model LA-202 LE venue awareness kit
4. Wireless Microphones:
   a. 16 @ Shure ULXD2/B87C handheld transmitter with Beta 58 head. Include a SB900A lithium-ion rechargeable battery pack and standard accessories with each transmitter
   b. 16 @ Shure ULXD1 belt-pack transmitter. Include a Countryman E6 ear set microphone (with mating connector, light beige color, omni pattern, W6 sensitivity) a SB900A lithium-ion rechargeable battery pack, and standard accessories with each transmitter
   c. 16 @ Shure SB900A rechargeable lithium-ion batteries for spares
   d. 2 @ Shure SBC200-US dual docking recharge station with US power supply
   e. 6 @ Shure SBC200 dual docking recharge station
   f. 2 @ Shure SBC800 8-up battery charger
5. Microphones. Provide a mic clip for each mic.
   a. 2 @ AKG C414 XLS
   b. 3 @ Audio Technica 4040.
   c. 4 @ Audio Technica 4041.
   d. 6 @ Audio Technica U853R hanging mics
   e. 5 @ Crown PCC160.
   f. 1 @ DPA 4099-DC-1-101-P
   g. 1 @ Shure VP88
   h. 6 @ Shure SM-58

i. 2 @ Shure SM-57
j. 2 @ Shure KSM-32
k. 1 @ Shure SD565

6. Microphone Stands & Accessories.
   a. 4 @ Atlas Sound DMS7E
   b. 6 @ Atlas Sound MS12CE
   c. 4 @ Atlas Sound MS20E
   d. 15 @ K&M KM210/91 black, mic stand w/boom
   e. 5 @ K&M KM21140 black boom arm
7. Audio Interfaces and Cables:
   a. 2 @ Countryman Type 85 Direct Box.
   b. 1 @ EMtech Electronics, Inc. Model EJ-8 multi-input adapter box.
   c. 1 @ Radial Engineering BT-PRO V2 bluetooth interface
   d. 1 @ Radial Engineering USB-Pro computer USB interface
   e. 1 @ Radial Engineering USB-MOBILE mobile device USB interface
   f. 1 @ Radial Engineering ProAV2 stereo multimedia direct box
   g. 6 @ Whirlwind MKQ mic cable 6 feet
   h. 6 @ Whirlwind MKQ mic cable 25 feet
   i. 8 @ Whirlwind Leader Elite ¼" TS instrument cable 6 feet
   j. 2 @ Whirlwind MST06US stereo 3.5mm to 3.5 mm cable
8. Intercom belt pack.
   a. 12 @ Clear-Com RS-701.
   b. 2 @ Clear-Com RS-702
9. Intercom speaker station (portable)
   a. 2 @ Clear-Com KB-702 w/ V-box
10. Intercom single muff headset.
    a. 12 @ Clear-Com CC-300
11. Intercom dual muff headset
    a. 2 @ Clear-Com CC-400
12. Intercom telephone handset
    a. 2 @ Clear-Com HS-6
13. Intercom cable, 6 pin XLR
    a. 2 @ 25 feet – Clear-Com IC-25/6
    b. 2 Clear-Com YC-36
14. Mic Cables: Whirlwind MKQ series in black.
    a. 10 @ 3 feet
    b. 15 @ 10 feet
    c. 15 @ 20 feet.
    d. 15 @ 30 feet.
    e. 6 @ 50 feet.
    f. 6 @ 100 feet.
15. Speaker Cables.
    a. 4 @ Whirlwind NL-4-75
    b. 8 @ Whirlwind NL-4-50
    c. 8 @ Whirlwind NL-4-25
    d. 4 @ Whirlwind NL-4-10
16. Patch Cables and Adapters - Audio
    a. 8 @ Neutrik NL4MM.
    b. 2 @ Switchcraft 389.
    c. 2 @ Switchcraft 390
    d. 2 @ Switchcraft 387A
    e. 2 @ Switchcraft 386A
    f. 2 @ Switchcraft 384A
    g. 2 @ Switchcraft 383A

17. Patch Cables and Adapters – Video
    a. 1 @ Liberty AV Solutions DL-ARDA
18. Monitor and Portable Speakers.
    a. 2 @ Electro-Voice SX300E
    b. 4 @ Electro-Voice ZX3 w/ stand sockets
    c. 4 @ Galaxy Hot Spots with volume control and 2 NL4 connectors
    d. 6 @ Ultimate Support TS-90B speaker stands
19. Headphones.
    a. 1 @ Sony MDR-7506

PART 3 - EXECUTION

3.1 STANDARDS COMPLIANCE

A. Comply with all local building codes.

B. In the absence of specific local codes, comply with the National Electrical Code (NFPA-70) as applicable to installation and construction of communication and control equipment.

C. Where not in conflict with local building codes or the National Electrical Code comply with industry standard professional practices.

D. Installation practices shall be in accordance with OSHA Safety and Health Standards

3.2 SHOP DRAWINGS AND SUBMITTAL

A. Within thirty days of the bid award and prior to beginning work, prepare and submit shop drawings and data cut sheet to the Architect for approval.

B. All of the following must be submitted at the same time
1. Shop Drawings: Complete shop drawings details and complete on all phases of installation including a minimum of:
    a. Device location plan drawing(s)
        1) Location of all devices
        2) Confirm box type – surface or flush – as acceptable and constructible based on box depth and wall construction
        3) Confirm color of all surface mount boxes
    b. Control booth layout – plan section and elevation drawings showing:
        1) All equipment
        2) All connection plates
        3) Panduit wire duct if required
        4) Free cable routing and required cable pass throughs / grommets
        5) Conduit
        6) Junction boxes
    c. System wiring diagram:
        1) Show Dante ID and other setup info
        2) Show wireless frequency coordination
        3) Show IP address management
        4) Show RF levels on TV distribution system
        5) Show EDID information and management
        6) Make and model of all equipment

7) All connection points on each piece of equipment
8) All wire types
9) All connector types
10) All cable labels

d. Rack drawings
1) Elevations showing all equipment labels
2) Section showing all equipment depth and rack rail locations
3) Power details

e. Details of all connection plates and custom panels including a complete itemized bill of materials for each plate and panel.

f. Mounting and rigging details for all equipment

g. Scale drawings showing the projector, the screen, the throw distance and all lens calculations in plan, front elevation, and section. Include all relevant architectural and stage rigging drawing details

h. Mountings and Attachments: Scale plan, section and elevations drawings of all proposed enclosures and speaker mounting or rigging weighing more than ten pounds. All mountings and attachments must be approved and stamped by an engineer licensed in Florida prior to submittal and the beginning of the installation.

2. Materials and Equipment submittal package:
a. A complete list of all materials and equipment to be furnished
b. Catalog cuts for all materials equipment
1) These must contain full information on dimensions, construction, applications, etc. to permit proper evaluation.
c. Catalog cuts must be properly identified as to their intended use and any options or variations must be clearly marked.
d. The contractor is to confirm equipment availability at time of submittal. It is assumed that all equipment submitted on is and will be available
e. Color selection samples of devices for Architect's selection.

3. Test Equipment: The sound contractor will submit to the owner a list of test equipment to be used to test, equalize and demonstrate the final installation.

4. Schedule: Prior to the commencement of the installation work, the sound contractor shall submit for approval, to the owner, an outline of a proposed commencement and completion schedule and project requirements.

C. Variations: Any deviation from what is specified here and or shown on the system drawings must be "starred", highlighted in yellow and noted in ¼" high letters on the shop drawings and submittal data.

D. Approval of shop drawings and materials does not relieve the Contractor of any responsibilities.

E. Samples may be requested by the Architect and shall be furnished for inspection at the Architect's office, at the Contractor's sole expense.

F. Submit in quantities as required by the Architect.

G. Shop drawing and submittals shall be revised and resubmitted as required.

H. Four months prior to system activation for contractor testing submit a complete written narrative describing all system DSP and control programming and functionality.

I. Two months prior to system activation for contractor testing submit the initial DSP configuration file and screen shots of all control pages for all control systems.

3.3 COORDINATION WITH OTHER WORK:

A. The sound contractor shall specifically coordinate the placement and sizes of conduit relating to this work and shall specifically review and approve the conduit rough-in in time to advise all parties of needed changes, omissions, etc. The sound contractor shall report this successful coordination in writing to the owner's representative. Failing this, the following will be enforced:
   1. The sound contractor shall provide and install any additional conduits required for the hookup, proper location and proper isolation of the various cable / signal types and equipment in the systems. The sound contractor must coordinate his conduit installation with those installed by the electrical contractor. All conduits shall be sized to their intended fill plus fifty percent.
   2. The contractor shall at all times coordinate his work with the other trades to ensure smooth progress of work and satisfactory final results.

3.4 INSTALLATION:

A. Personnel: A single, competent, technically qualified foreman will oversee the entire job from start to finish. This foreman must:
   1. Be present on the job site during all phases of installation and testing.
   2. Be authorized to receive instructions from the Architects or their representatives.

B. Only experienced sound installers shall be employed on this job.

C. The contractor shall keep the job adequately staffed at all times.

D. All job documents pertaining to the installation of this system will be accessible to all workers throughout the installation process.

E. Installation practices shall be in accordance with OSHA Safety and Health Standards and all local codes.

F. The sound contractor shall not commence the installation of equipment and devices, other than the pulling of cable, until all areas are clean, painted and finished to a point that they are completely dust, dirt, lint, fiber and airborne particle free. The air conditioning system must be operating to its design level and be able to keep all areas with sound equipment stable.

G. General Workmanship:
   1. The installation of all work shall be neat.
   2. All boxes, equipment, etc shall be plumb and square.
   3. The installation shall conform to the plans and spec.
   4. Equipment racks shall be assembled, wired and tested in the contractors shop prior to delivery to the job site.

H. Wiring:
   1. If enclosed in conduit run only similar signal levels in a single conduit.
   2. All pulls to be made be hand, care will be taken not to nick cable jackets, and any nicked or damaged cable will be replaced.
   3. A pull string will be left in all conduits after wire is installed.
   4. NO SPLICES WHATSOEVER IN CONDUIT!
   5. If not enclosed in conduit neatly group cables into bundles and secure out of harms way.
   6. Separate cable grouping by signal level. Mic and A.C. power shall be not less that 18" all other levels by not less than 6".

7. Include spare cables with all field runs. Quantity to be 10% or 1 which ever is greater unless otherwise specified.
8. All category type cabling must be certified.

I. Terminations:
1. All cables shall be permanently labeled at every termination.
2. Service loops of not less than 6" will be present at all terminations to equipment.
3. Where terminal blocks or barrier strips are used only uninsulated fork terminals with a brazed seam, sized according to wire and stud sizes, crimped with notch across from the seam will be approved.
4. Use barrier strips on equipment where provided.
5. Where shielded cable is in use leave shield drain wire the same length as the circuit conductor(s), sleeve shield drain wire in green pvc tubing. Cap where the cable jacket was removed with heat shrink. Where the shield drain wire is to be lifted follow the above and fold back over cable jacket. Then cap end with heatshrink. Do not use a single piece of heatshrink for this use two smaller ones.
6. All soldering will be clean and neat and not exhibit evidence of a " cold" joint, were necessary heat sinks will be used. Use only rosin core "electronic type " solder.
7. Wire nuts will be allowed only for field connections of 70 volt speaker lines and priority attenuation control lines, and then only when the proper size is used.

J. Polarity:
1. The " high " side will be connected to pin 2 on XLR connectors, to tip on 1/4" connectors and to the pin on phono connectors.
2. The " low " side will be connected to pin 3 on XLR connectors, to ring on 1/4" balanced connectors and to case on phono connectors.
3. Microphones will be wired so that an acoustic compression at the diaphragm produces a positive going signal on pin 2 with respect to pin 3.
4. Speakers will be wired so that when a positive going signal is applied to the + or red terminal an acoustic compression is produced.
5. The system will be wired to maintain absolute polarity though all system components to insure that a positive signal on pin 2 or tip produces a positive signal at the + or red speaker terminal.

K. Shield Grounding:
1. Do not tie pin 1 to case of XLR connectors anywhere.
2. Microphone shield drain wires will be grounded only at mixer inputs. Where microphone lines and mixer inputs run though a patchbay, connect shield drain wire to sleeve of patchbay connector and only to this point.
3. Line level lines will have shield drain wire connected to ground at outputs and lifted from ground at inputs.
4. The intent here is to not make ground loops, should any situation arise which would form a ground loop, please inform the owner for direction.

L. Mountings and Attachments:
1. Any and all structural, mounting, or rigging details are shown on the drawings for concept only.
2. The detail drawings and calculations of all proposed mounting or rigging of any equipment weighing more than ten pounds will be approved and stamped by a P.E. who is licensed in Florida.
3. Each cluster element is to be individually adjustable. A line array is considered in whole as a single element for these purposes.
4. Provide for an adjustment range of +/- 10 degrees from the information shown in the contract documents.

5. In the absence of specific direction otherwise, standard rigging practices shall be followed.

M. Labels:
1. Cable Labels: All cables shall be labeled at all termination points. The label shall not be hand written. Clear heat shrink shall cover the label.
2. Equipment Labels. All equipment shall be labeled front and rear. Labels shall functionally describe the use of each piece of equipment. On equipment having multiple channels, each channel shall be labeled. Additionally the equipment label will call out equipment designation which will correspond with the designations shown on the approved contractor's one-line diagram. Labels shall be engraved lanacoid, white letters on black background, with a minimum letter size of 3/16". Approved patchbay labeling may vary from this.

N. Power Sequencing. The system shall turn on and off, in proper order, on circuit at a time, when the power switch is pressed. The power light shall be solid on when all circuits are on , and shall flash during sequencing.

O. The system may not be used prior to checkout.

3.5 INSPECTION AND TESTING:

A. During the installation of the equipment the sound contractor shall arrange for access as necessary for inspection of equipment by the owner's and/or architect's representatives.

B. Provide a safe means of accessing all system components for all visits.

C. Equipment Pretesting:
1. All racks are to be built and wired in contractors shop and tested prior to delivery to site.
2. All other equipment is to be tested prior to delivery and installation.
3. All site wiring and terminations must be tested and documented.
4. A written test report will be submitted to the owner that will include at a minimum:
   a. Transfer function measurements showing frequency response, phase response and either coherence or signal / noise ratio for each speaker.
   b. A composite chart which overlays all similar speaker model plots onto a single chart where the magnitude of the frequency response has been normalized across all included speakers.
   c. Cable certifier printouts of all category type cable links.
   d. TDR plots of all coax type cabling.
   e. RF levels at all TV taps.
   f. Cable tester reports for open / shorts / crossover / connections to ground of all mic jack, line jack, monitor speaker and tie line cabling.
   g. Speaker Z plots for all installed speakers /speaker lines. 70V systems need not be separated, all other speaker lines must be measured one speaker at a time.
   h. A composite cart which overlays all similar speaker Z plots onto a single chart.
   i. Screen shots of Dante controller showing all routing, addressing, status and performance parameters.
   j. DM Tools – DM frame test report
   k. Photo showing projection screens deployed and projected test images

D. Final Inspection:

1. The final inspection will confirm that the systems, as installed, meets the requirements of this spec, the contract documents, and the approved contractor's shop drawing and submittals.
2. The Theatre Consultant or his representative will conduct all final system tests and equalization adjustments in order to determine final acceptance.
3. In no event shall the installation be submitted for final approval or acceptance until any and all elements of the facility that may have a bearing on the system performance, including but not limited to doors, windows, HVAC, carpeting, furniture, wall coverings, interior design elements, lighting and lighting control systems have been completed and are operable. All elements that may effect sound systems operation or performance shall be "on" and operating during adjustments. The sound contractor will be responsible for coordinating the requirements of this paragraph with other work on the project.
4. The contractor will inform the owner in writing of the system's completion. The contractor will then request final inspection by the consultant, and carry out the necessary coordination. This coordination includes:
    a. Giving at least fourteen days notice to the consultant prior to the final inspection.
    b. Arranging for the contractor's and consultant's exclusive use of the space.
    c. Arranging for a HVAC technician to be available to turn the AC system on and off as required.
    d. Arranging for a lighting technician to be available to control the stage lighting as required.
    e. The contractor's job foreman and one additional worker familiar with the job will be present during all check out, testing and tuning.
5. Contractor will complete the following tasks prior to consultant's arrival:
    a. Unpack and assemble all portable equipment.
    b. Place all portable equipment in one location.
    c. If anything has been turned over to the owner have the signed Letters of Transmittal on site.
    d. Complete all required paperwork (pre-testing reports, letters indicating successful coordination of the installation, etc.).
    e. Remove all security covers.
    f. Unlock all doors
6. Contractor will provide all necessary software, cables, and interfaces to facilitate the setting of computer, remote controlled, or DSP based equipment.
7. Contractor will either:
    a. Relocate all system equalizers to a tech area in the house for the duration of system tuning
    b. Or for remotely controllable devices, locate the control position in a tech area in the house for the duration of system testing.
    c. In ether case a tech area in the house will be required with a minimum of a 4' x 6' folding table, intercom communications to the rack and console locations, and AC power.
8. Contractor will provide the following test equipment for use during tuning and acceptance testing:
    a. Sennheiser ZP-3 impedance bridge.
    b. Low distortion sine wave oscillator with variable sweep (start frequency, stop frequency, and sweep rate).
    c. Distortion meter.
    d. Oscilloscope dual channel, 100Mhz, .001v/div vertical amp.
    e. Noise generator that will provide pink, white, or bandwidth limited pink noise.
    f. 1/3 octave real time audio spectrum analyzer or a precision sound level meter with filter set.
    g. Polarity checker.
    h. Precision true R.M.S. reading A.C. millivolt meter with dB scale.

i. Playback and recording media for testing all supplied source equipment.
j. Meyer Sound SIM 3 with all interconnection cabling and a DPA 4007 mic with calibrator OR a full Smaart rig OR a full SysTune rig.
k. Speaker Z measuring adaptor for the above test systems or dedicated complex impedance measurement set.

9. Contractor will provide safe means to access all system components during the entire commissioning process.
10. Contractor shall provide personal and equipment to make adjustments to the speaker cluster(s), as well as to correct problems, for the entire inspection and testing period.

E. Should more than two trips be required to complete the systems testing, systems tuning, and clearing punch list items, the contractor will be charged for any additional visits. These charges will include:
1. A minimum of two people at a rate of $1520 per day per person.
2. Travel expense to and from the job site.
3. These charges will be paid to the consultant, in advance of the consultant's arrival on the job site.

3.6 MANUALS:

A. Prepare four identical copies of owner's manuals. The owner is to receive two, the consultant receives one and the contractor retains one. Before distribution of manuals submit one copy to consultant for approval. Each manual is to contain the following:
1. System one line drawing including all labeling and changes (" as builts ").
2. Owners manual for each piece of equipment.
3. Schematic diagram for each piece of equipment.
4. Contractors service phone number in a conspicuous place.
5. All test reports.
6. Electronic (PDF) copy of the manual (indexed with TOC and links to sections)
7. Electronic (USB flash drives) loaded with the PDF manual and all software, drivers and configuration files.

3.7 INSTRUCTION: The following is to be carried out within two months of system acceptance:

A. Provide a total of 12 hours of instruction, on a maximum of two occasions. This is to be time on site, travel time is not to be included within the allotted time.

B. Provide operational assistance for the first usage of the system. This is to be on the owners time schedule but, not to exceed 8 hours.

3.8 WARRANTY

A. Contractor will warrant the system to be free from defects in materials and workmanship for a period of one year from the date of acceptance, or first beneficial use, which ever comes first.

B. Acts of god and owner abuse, or neglect are not covered.

C. During the warranty period the contractor will respond to and correct any call for service within one day of the call. Loaner equipment will be provided if necessary.

END OF SECTION 27 41 52

Division 28

Electronic Safety and Security

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SECTION 28 00 00
ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. This document describes the general requirements relating to Electronic Safety and Security Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

D. Related Specifications:

1. Division 00
2. Division 01
    a. Section “Project Management and Coordination”
    b. Section “Submittal Procedures”
    c. Section “Product Requirements”
    d. Section “Closeout Procedures”
    e. Section “Warranties”
3. Division 07 Section "Firestopping"
4. Division 08 Section "Access Doors and Frames."
5. Division 09 Section "Interior Painting"
6. Division 26
    a. Section “Grounding and Bonding for Electrical Systems”
    b. Section “Raceway and Boxes for Electrical Systems”
    c. Section “Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits”
7. Division 27 all applicable Sections
8. Division 28 all Sections

E. Applicable requirements of the Division 26, 27 and 28 Design Criteria shall all be considered a part of this Division and shall have the same force as if written herein full.

1.2 QUALITY ASSURANCE

A. Specifications, Standards and Codes: All work shall be in accordance with the following:

1. 2010 Florida Building Code (FBC) with 2012 supplement
2. Standard Requirements for Educational Facilities (SREF)
3. The 2008 edition of the National Electrical Code (NFPA 70)

4. American National Standards Institute (ANSI)
5. National Electrical Manufacturers Association (NEMA)
6. Telecommunications Industries Association (TIA)
7. Electronic Industries Association (EIA)
8. Institute of Electrical & Electronics Engineers (IEEE)
9. Underwriters Laboratories (UL)

    a. U.L. 13 - Power-Limited Circuit Cables
    b. U.L. 444 - Communications Cables
    c. U.L. 497 - Protectors for Paired Conductor Communication Circuits
    d. U.L. 497A - Secondary Protectors for Communication Circuits
    e. U.L. 497B - Protectors for Data Communication and Fire Alarm Circuits
    f. U.L. 910 - Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air
    g. U.L. 1449 - Transient Voltage Surge Suppressors
    h. U.L. 1581 - Reference Standard for Electrical Wires, Cables AND Flexible Cords.
    i. U.L. 1666 - Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
    j. U.L. 1685 - Vertical-Tray Fire Propagation and Smoke Release Test for Electrical and Optical-Fiber Cables
    k. U.L. 1778 - Uninterruptible Power Supply Equipment

10. American Standards Association (ASA)
11. Building Industry Consulting Services International (BICSI)
12. Federal Communications Commission (FCC)
13. Occupational Safety and Health Administration (OSHA)
14. American Society of Testing Material (ASTM)
15. Americans with Disabilities Act (ADA)
16. Local city and county ordinances governing electrical work
17. The County of Volusia Voice, Video Data Infrastructure Guidelines
18. In the event of conflicts, the more stringent provisions shall apply.

1.3 SUMMARY

A. The work to be done under this division of the Specifications shall include the furnishing of labor, material, equipment and tools required for the complete installation of the work indicated on the Drawings or as specified herein.

B. All materials, obviously a part of the Security Infrastructure and necessary to its proper operation, but not specifically mentioned or shown on the Drawings, shall be furnished and installed without additional charge.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the engineer shall be notified of the discrepancy.

1.4 WORK INCLUDED

A. The Electronic Safety and Security Infrastructure installed and work performed under this Division of the Specifications shall include but not necessarily be limited to the following:

1. Security systems cabling infrastructure.
2. Security systems conduits, raceways, cable tray, racks, cabinets, panels and equipment mounting boards.
3. Grounding and Bonding of Electronic Safety and Security Equipment.
4. Electronic Safety and Security Life Safety Plan for construction site specific.

1.5 DEFINITIONS

A. Terms: The following definitions of terms supplement those of the General Requirements and are applicable to Division 28 – Electronic Safety and Security.

B. Provide: As used herein shall mean “furnish, install and test (if applicable) complete.”

C. Infrastructure: As used herein shall mean cable, conduit, raceway, cable tray or j-hooks with all required boxes, fittings, connectors, and accessories; completely installed.

D. Work: As used herein shall be understood to mean the materials completely installed, tested and certified including the labor involved.

E. Main Distribution Frame (MDF): The primary communications room for a facility used to house head-end equipment for various systems and interconnect with equipment in other communications rooms and spaces via backbone cables.

F. Intermediate Distribution Frame (IDF): Secondary communications rooms located throughout a facility and used to extend horizontal cables to system devices.

1.6 DRAWINGS

A. Drawings are generally diagrammatic and show the arrangement and location of pathways, outlets, support structures and equipment. The Contractor shall carefully investigate the structural and finish conditions affecting his work and arrange his work accordingly. Should conditions on the job make it necessary to make adjustments to pathways or materials, the Contractor shall so advise the Engineer and secure approval before proceeding with such work.

B. Where exact locations are required by equipment for stubbing-up and terminating conduit concealed in floor slabs, the Contractor shall request shop drawings, equipment location drawings, foundation drawings, and any other data required by him to locate the concealed conduit before the floor slab is poured.

C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

D. The right is reserved to make reasonable changes in locations of equipment indicated on Drawings prior to rough-in without increase in contract cost.

E. The Contractor shall not reduce the size or number of conduit runs indicated on the Drawings without the written approval of the Engineer.

F. Any work installed contrary to Contract Drawings shall be subject to change as directed by the Engineer, and no extra compensation will be allowed for making these changes.

G. The location of equipment, support structures, outlets, and similar devices shown on the Drawings are approximate only. Do not scale Drawings. Obtain layout dimensions for equipment from Architectural plans unless indicated on Communications plans.

H. Schematic diagrams shown on the Drawings indicate the required functions only. The technology of a particular manufacturer may be used to accomplish the functions indicated without exact adherence to the schematic Drawings shown. Additional labor and materials required for such deviations shall be furnished at the Contractor's expense.

I. Verify the ceiling type, ceiling suspension systems, and clearance above hung ceilings prior to ordering cabling and associated hardware. Notify the Engineer of any discrepancies.

J. Review all drawings for modular furniture, power poles and other conditions that may require additional coordination by the contractor.

K. Portions of these Drawings and Specifications are abbreviated and may include incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as indicated on the Drawings,” “In accordance with,” “a,” “the” and “all are intended” shall be supplied by inference.

1.7 SUBMITTALS

A. Required to be submitted prior to the commencement of work:

1. Contractor qualifications information including but not limited to:

   a. Name, qualifications, etc. of company providing and installing system
   b. Submit copy of Florida Registered Firm certificate
   c. Submit copy of Florida Contractor's license
   d. Contractor certification by manufacturers
   e. Narrative of System Operation
   f. Detailed step-by-step testing procedure for a functional checkout and test

B. Submit for approval, details of all materials, equipment and systems to be furnished. Work shall not proceed without the Owner and/or the Project Manager's approval of the submitted items. Four (4) copies of the following shall be submitted:

1. Submittals for individual systems and equipment assemblies that consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered, reviewed or stored, and such submittals will not be returned except at the request and expense of the Contractor.
2. Shop drawings shall include equipment racks, patch panels, termination blocks, connection details, rack mounting details and any other details not included in the construction drawings.

C. Any materials and equipment listed that are not in accordance with Specification requirements may be rejected.

D. The approval of material, equipment, systems and shop drawings is a general approval subject to the Drawings, Specifications and verification of all measurements at the job. Approval does not relieve the Contractor from the responsibility of shop drawing errors.

The Contractor shall carefully check and correct all shop drawings prior to submission for approval.

1.8 QUALITY ASSURANCE

A. Equipment and materials required for installation under these Specifications shall be the current model and new (less than one [1] year from the date of manufacture), unused and without blemish or defect.

B. Equipment shall bear labels attesting to Underwriters Laboratories, where subject to label service. Manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacture of said equipment a minimum of ten (10) years and, if so directed by the Owner, be able to furnish proof of their ability by submitting affidavits and descriptive data about their product including size and magnitude comparable to requirements specified herein.

1.9 CONTRACTOR QUALIFICATIONS

A. The Contractor shall have total responsibility for the coordination and installation of the work shown and described in the Drawings and Specifications. The Contractor shall be a company specializing in the design, fabrication and installation of integrated Security systems.

B. Security Systems specified shall be installed under the direction of a qualified System Manufacturer Certified Contractor. Qualification requirements shall include submittal by the Contractor to the Architect of the following:

1. List of previous projects of this scope, size and nature; including names and sizes of projects, description of work, time of completion and names of contact persons for reference.
2. Shall certify that they are manufacturer-authorized for work to be performed.

C. The Contractor shall maintain an office within fifty (50) miles of the project site with the capability to provide emergency response.

D. The Installer shall be a direct sales division of, or an authorized and designated dealer for the equipment manufacturer whose product he intends to install.

E. The Installer shall be currently licensed by the Electrical Contractor’s Licensing Board with the appropriate license for the system he intends to install.

F. Sub-Installers (i.e., Installers two levels beneath the Electrical Sub-Contractor) shall not be allowed.

1.10 COORDINATION WITH OTHER TRADES

A. The Contractor shall coordinate the Security systems work with that of other sections as required ensuring that the entire Electronic Safety and Security work will be carried out in an orderly, complete and coordinated fashion.

1.11 PERMITS

A. Obtain all permits and inspections for the installation of this work and pay all charges incident thereto. Deliver to the Owner all certificates of said inspection issued by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Where equipment is identified by manufacturer and catalog number, it shall be as the base of requirements for quality and performance. Where manufacturers for equipment are identified by name, the Contractor may submit for approval, similar equipment of other manufacturers as substitution. The Engineer's decision as to whether the submitted equipment is acceptable shall be final and binding.

B. All changes necessary to accommodate the substituted equipment shall be made at the Contractor's expense, and shall be as approved by the Engineer. Detailed drawings indicating the required changes shall be submitted for approval at the time the substitution is requested.

C. If substitutions are made in lieu of device specified; form, dimension, design and profile shall be submitted to the Engineer for approval.

D. Submit request for approval of substitute materials in writing to the Architect at least five days prior to bid opening.

2.2 MATERIALS

A. All materials used in this work shall be new and shall bear the inspection label of Underwriters' Laboratories Inc. or certification by other recognized laboratory.

B. The published standards and requirements of the Telecommunications Industries Association (TIA), National Electrical Manufacturers Association (NEMA), the American National Standard Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), and the American Society of Testing Materials (ASTM), are made a part of these Specifications and shall apply wherever applicable.

C. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.

D. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer or partner manufacturers that offer a certified solution.

E. Components of an assembled unit need not be products of the same manufacturer, but must offer a certified end-to-end solution.

F. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

G. Components shall be compatible with each other and with the total assembly for the intended service.

H. The contractor shall be responsible for the delivery, receipt, and safe storage on site of all Electronic Safety and Security systems materials and equipment to the job site until the job is completed and the owner accepts the equipment or installation. Replace any damaged materials or equipment.

I. Records shall be kept of all materials and equipment delivered to the job site in the form of shipping manifests, bills of laden or signed receipts.

J. At the end of the installation all remaining Electronic Safety and Security systems materials and equipment will be inventoried and turned over to the owner.

PART 3 - EXECUTION

3.1 EXAMINATION OF CONDITIONS

A. Prior to the start of work, the Contractor shall carefully inspect the installed work of other trades and verify that such work is complete to the point where installation may properly commence. Start of work indicates acceptance of conditions.

B. Install equipment in accordance with applicable codes and regulations, the original design and the referenced standards.

C. In the event of a discrepancy, immediately notify the Project Engineer and owner.

D. Do not proceed with installation until unsatisfactory conditions and discrepancies have been fully resolved.

3.2 PROTECTION OF SYSTEMS AND EQUIPMENT

A. Protect materials and equipment from damage during storage at the site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, theft, moisture, extreme temperature and rain.

B. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering the sides with securely fastened protective rigid or flexible waterproof coverings.

C. During installation, equipment shall be protected against entry of foreign matter on the inside and be vacuum cleaned both inside and outside before testing, operating or painting.

D. As determined by the Owner or Engineer, damaged equipment shall be fully repaired or shall be removed and replaced with new equipment to fully comply with requirements of the Contract Documents. Decision of the Owner or Engineer shall be final.

E. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with the same quality of paint and workmanship as used by the manufacturer.

3.3 ACCESS TO EQUIPMENT

A. Equipment shall be installed in location and manner that will allow convenient access for maintenance and inspection.

B. Working spaces shall be not less than specified in the National Electrical Code (NEC).

C. Where the Project Manager determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled, one time only, as directed by the Project Manager, at no additional cost to the Owner. “Conveniently accessible” is defined as being capable of being reached without the use of ladders or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and duct work.

3.4 CLEANING

A. During construction, and prior to Owner acceptance of the building, remove from the premises and dispose of packing material and debris caused by communications work.

B. Remove dust and debris from interiors and exteriors of electrical equipment. Clean accessible current carrying elements prior to being energized.

3.5 COMPLETION

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and similar items. Leave the premises clean, neat and orderly.

B. Results Expected: Systems shall be complete and operational and controls shall be set and calibrated. Labeling, testing, start-up and cleaning work shall be complete.

C. Maintenance Materials: Special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered to the Owner.

3.6 TESTING AND VERIFICATION

A. See specific Division 28 section for testing parameters of Security sub-systems.

B. The Contractor shall verify that requirements of this Specification are met. Verification shall be through a combination of analyses, inspections, demonstrations and tests, as described below.

C. Verification by inspection includes examination of items and comparison of pertinent characteristics against the qualitative or quantitative standard set forth in the Specifications. Inspection may require moving or partially disassembling the item to accomplish the verification, included as part of the work at no additional cost to the Owner.

D. The Contractor shall verify by formal demonstrations or tests that the requirements of this Specification have been met. The Contractor shall demonstrate that the Electronic Safety and Security systems, components and subsystems meet Specification requirements in the “as-installed” operating environment during the “System Operation Test.” Even though no formal environmental testing is required, the Contractor shall

measure and record temperature, humidity and other environmental parameters and the environmental conditions, which were encountered during the “System Operation Test.”

E. The Contractor shall carefully plan and coordinate the final acceptance tests so that tests can be satisfactorily completed. The Contractor shall provide necessary instruments, labor and materials required for tests, including the equipment manufacturer's technical representative and qualified technicians in sufficient numbers to perform the tests within a reasonable time period.

F. The Contractor shall satisfy all items detailed in the final acceptance check-off list (punch list). The list shall be a complete representation of specified installation requirements. At the time of final acceptance punch list items shall be corrected until the system is found to be acceptable to the Owner and the Project Manager.

G. After the Contractor systems have been installed and tested, the completed test plan shall be signed by the Security System Contractor Project Manager and submitted for approval.

3.7 MAINTENANCE SERVICE

A. The Contractor shall furnish service and maintenance of each system for one (1) year from date of acceptance by the Owner.

1. No charges shall be made by the Installer or Contractor for any labor, equipment, materials, or associated services during this period to maintain functions of the system.
2. Respond to trouble call within twenty-four (24) hours after receipt of such call.

B. The Contractor shall, at the Owner’s request, make available a service contract offering continuing factory authorized service of this system after the initial warranty period.

C. The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final closeout of the system.

END OF SECTION 28 00 00

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SECTION 28 05 00
COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceways and cables.
2. Sleeve seals.
3. Grout.
4. Common electronic safety and security installation requirements.

1.3 SUBMITTALS

A. Product Data: For sleeve seals.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Metraflex Co.
    d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

A. Electronic safety and security penetrations occur when raceways, pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping

materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 28 05 00

SECTION 28 05 13
CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. UTP cabling (for POE devices).
2. Wiring for access control.
3. Identification products.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

E. RCDD: Registered Communications Distribution Designer.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

C. Source quality-control reports.

D. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing for UTP cabling installation.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test each pair of UTP cable for open and short circuits.

1.7 PROJECT CONDITIONS

A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.

B. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

B. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit; a business unit of Tyco Electrical & Metal Products.
b. Cablofil.
c. Cooper B-Line, Inc.
d. GS Metals Corp.

2. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by hot-dip galvanizing, complying with ASTM A 123/A 123M Grade 0.55, not less than 0.002165 inchthick.

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches mounted 6” Above Finished Floor, AFF. Comply with requirements for plywood backing panels in Division 6 Section "Rough Carpentry".

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Panduit Corp.

B. Description: 100-ohm, Category 6, 4-pair UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

a. Communications, General Purpose: Type CM or CMG; or MPP, CMP, MPR, CMR, MP, or MPG.
b. Communications, Plenum Rated: Type CMP or MPP, complying with NFPA 262.
c. Communications, Riser Rated: Type CMR; or MPP, CMP, or MPR, complying with UL 1666.
d. Communications, Limited Purpose: Type CMX; or MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG.
e. Multipurpose: Type MP or MPG; or MPP or MPR.
f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
g. Multipurpose, Riser Rated: Type MPR or MPP, complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panduit Corp.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: 110-style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.5 WIRING FOR ACCESS CONTROL

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. West Penn
2. Belden
3. Or approved equal

B. Contractor to coordinate cable requirement with door hardware provider and all equipment manufacturers prior to purchasing cables.

2.6 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.7 SOURCE QUALITY CONTROL

A. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

B. Factory test UTP cables according to TIA/EIA-568-B.2.

C. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3.

D. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA-569-B.

B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.

C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

D. Install manufactured conduit sweeps and long-radius elbows whenever possible.

E. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 2 inchesabove finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: Install backboards with 96-inchdimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems" for installation of supports for pathways, conductors and cables.

3.3 WIRING METHOD

A. Install wiring in metal raceways and wireways. Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 1 inch, unless noted otherwise on plans. Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Install wiring in raceways except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch. Control and data transmission wiring shall not share conduit with other building wiring systems.

C. Install cable, concealed in accessible ceilings, walls, and floors when possible.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.4 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.

C. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inchesand not more than 6 inchesfrom cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

D. UTP Cable Installation: Install using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.

1. Comply with TIA/EIA-568-B.2.
2. Install 110-style IDC termination hardware unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inchesabove ceilings by cable supports not more than 60 inchesapart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.5 POWER AND CONTROL-CIRCUIT CONDUCTORS

A. 120-V Power Wiring: Install according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.

B. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No. 14 AWG.
2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.6 CONNECTIONS

A. Comply with requirements in Division 28 Section "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.7 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Through-Penetration Firestop Systems."

B. Comply with TIA-569-B, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.8 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.9 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and Division 27 Section “Identification for Communications Systems”.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

C. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 28 05 13

SECTION 28 08 00
COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Applicable requirements of Division 28 – Security Systems shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the equipment and execution requirements relating to Commissioning of Communications.

C. Equipment specifications, general considerations, and guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.3 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - TESTING

2.1 TESTING REQUIREMENTS

A. General:

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA-568-C.0, ANSI/TIA-568-C.1, and/or ANSI/TIA-1152. All conductors/strands of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors/strands in all cables installed.

B. Copper Testing:

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required

to verify Category 6A performance. Horizontal balanced twisted pair cabling shall be tested using a level IIe, III, or IV test unit for Category 6 performance compliance.

2. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. The test shall be recorded as pass/fail as indicated by the test unit and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
3. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA-568-C.2 Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
4. Approved tester is as follows:
   Fluke DTX

C. Test Results:

1. Test documentation shall be provided in 3 hard copies and 3 electronic copies on disk as part of the as-built package. The disk shall be clearly marked on the outside front cover with the words “Project Test Documentation,” the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair (or strand) and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
2. The field test equipment shall meet the requirements of ANSI/TIA-568-C.2, ANSI/TIA-568-C.3, and/or ANSI/TIA-1152.
3. Three bound printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. These CDs shall contain the electronic equivalent of the test results as defined by the Specification and be of a format readable from Microsoft Word.
4. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

PART 3 - DOCUMENTATION, AS-BUILTS, TRAINING AND RECORDS

3.1 DOCUMENTATION AND AS-BUILTS

A. As-Built record documentation for communications work shall include:

1. Cable routing and identification
2. End user outlet labeling
3. System function diagrams

4. Manufacturers' description literature for equipment
5. Connection and programming schedules as appropriate
6. Equipment material list including quantities
7. Spare parts list with quantities
8. Details not on original Contract Documents
9. Test results
10. Warranties
11. Release of liens

B. The Contractor shall provide and maintain at the site a set of prints on which shall be accurately shown the actual installation of all work under this section, indicating any variation from contract drawings, including changes in pathways, sizes, locations and dimensions. All changes shall be clearly and completely indicated as the work progresses.

C. Progress prints shall be available for inspection by the Owner or any of his representatives and may be used to determine the progress of communications infrastructure work.

D. At the completion of the work, prepare a new set of as-built drawings, of the work as actually noted on the marked-up prints, including the dimensioned location of all pathways.

E. Furnish as-built drawings and documentation to the Project Manager. As-built drawings shall be generated in AutoCad 2006 or later. Submit 3 copies of as-built drawings electronically on C.D. and hard copy.

3.2 OPERATIONS AND MAINTENANCE MANUAL

A. After completion of the work, the Contractor shall furnish and deliver to the Engineer three (3) copies of a complete Operations & Maintenance Manual. A system wiring diagram shall be furnished for each separate system.

B. The manual shall be subdivided into separate sections with tab dividers to identify subsystems of the integrated system. Reference appropriate Specification sections.

C. Provide the following additional information for each electronic system. Information shall be edited for this project where applicable.

1. Operations manuals for components and for systems as a whole.
2. Maintenance manuals for components and for system as a whole.
3. Point-to-point diagrams, cabling diagrams, construction details and cabling labeling details.
4. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
5. Emergency instructions for operational and maintenance requirements.
6. Delivery time frame for replacement of component parts from suppliers.
7. Recommended inspection schedule and procedures for components and for system as a whole.
8. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
9. Complete “reviewed” shop drawings and product data for components and system as a whole.

10. Troubleshooting procedures for each system and for each major system component.

3.3 TRAINING

A. The Contractor shall be responsible for training of facility personnel. Training shall take place after occupancy and before acceptance and shall include programs for on-site operations and maintenance of technology and communications systems. Training shall be for not more than ten (10) people, shall be held at the Owner's site and shall be of sufficient duration and depth to ensure that the trained personnel can operate the installed systems and can perform usual and customary maintenance actions. The contractor shall record the training and provide (3) DVD copies of the training to the project manager.

3.4 WARRANTY

A. General:

1. All equipment is to be new and warranted free of faulty workmanship and damage.
2. Replacement of defective equipment and materials and repair of faulty workmanship within 24 hours of notification, except emergency conditions (system failures), which must be placed back in service within eight (8) hours of notification, all at no cost to the Owner.
3. The minimum warranty provisions specified shall not diminish the terms of individual equipment manufacturer's warranties.

B. CCTV Surveillance System:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed CCTV Surveillance System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

C. Access Control System:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Access Control System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

D. Digital Fire Alarm System:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Access Control System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

E. Pathway and Support Infrastructure:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Pathway & Support Infrastructure. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

END OF SECTION 28 08 00

SECTION 28 13 00
ACCESS CONTROL SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Complete Access Control system interfaced into the campus wide system, as shown on the drawings and specified herein, includes supplementary or miscellaneous items, equipment and devices incidental to or necessary for a complete system installation, system testing, system programming, and owner employee training. Contactor responsible for all equipment, wiring, cabling, low voltage conduit, and programming necessary to provide 100% functional Access Control system.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The door raceway preparations to include boxes, and conduits stubbed to above the ceiling on the secured side of the portal shall be performed by the electrical contractor under Division 26 of the specifications.

C. The network cabling equipment will be installed, tested, and commissioned under Division 27 Specification, and associated drawings. This includes fiber, POE switches, raceway, cabling, labels, and terminations.

D. The door hardware will be provided by the door contractor under Division 08 of the specifications.

1.4 STANDARDS

A. Specifications, Standards and Codes: All work shall be in accordance with the following:

1. The 2011 edition of the National Electrical Code (NFPA 70)
2. American National Standards Institute (ANSI)
3. National Electrical Manufacturers Association (NEMA)
4. Telecommunications Industries Association (TIA)
5. Electronic Industries Association (EIA)
6. Institute of Electrical & Electronics Engineers (IEEE)
7. Underwriters Laboratories (UL)
8. American Standards Association (ASA)
9. Building Industry Consulting Services International (BICSI)
10. Federal Communications Commission (FCC)

11. Occupational Safety and Health Administration (OSHA)
12. American Society of Testing Material (ASTM)
13. Americans with Disabilities Act (ADA)
14. Local city and county ordinances governing electrical work
15. In the event of conflicts, the more stringent provisions shall apply.

1.5 DEFINITIONS

A. Credential: Data assigned to an entity and used to identify that entity.

B. DTS: Digital Termination Service. A microwave-based, line-of-sight communication provided directly to the end user.

C. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.

D. Location: A Location on the network having a PC-to-controller communications link, with additional Controllers at the Location connected to the PC-to-controller link with TIA 485-A communications loop. Where this term is presented with an initial capital letter, this definition applies.

E. PCI Bus: Peripheral Component Interconnect. A peripheral bus providing a high-speed data path between the CPU and peripheral devices such as monitor, disk drive, or network.

F. RAS: Remote access services.

G. TWAIN: Technology without an Interesting Name. A programming interface that lets a graphics application, such as an image editing program or desktop publishing program, activate a scanner, frame grabber, or other image-capturing device.

H. Interface: The ability to provide operational functions between two/multiple separate systems by the use of relay logic along with specific wiring connected between the systems to provide the function.

I. Integration: The ability to provide operational functions between two/multiple systems by the use of open architecture computer software and the existing communication CAT cable.

1.6 SCOPE OF WORK

A. Conceptual Design:

1. The Access System will be of an open-architecture design to integrate along with multiple systems. The system will utilize smart card technology and readers as specified in this specification.
2. Control Equipment: The main access control equipment cabinets, along with the servers, POE switch(es), UPS power, and fiber connections will be provided in the MDF room of the Building

3. Monitoring Work Station: provided in the CONTROL ROOM of the Dining/Admin Building and at any other PC location with the system software and network access installed for system management.
4. Network Equipment:

    a. The remote Access Control equipment cabinet along with the fiber connections, POE switch(es), and UPS power will be provided in the MDF and/or IDF room(s) of each building.
    b. The cabinets, fiber, POE switch(es), CAT cable, labeling, and connections are to be provided by the Network Communication Contractor to connect the door controllers to the control equipment.

5. Door Hardware: The door hardware strikes, maglocks, door operators will be provided by the door contractor under section 8.
6. Door Hardware Raceways: The raceway from the door controllers to the door equipment to be provide by the electrical contractor under Division 16 of the specifications.
7. Access Equipment: The access equipment readers, REX buttons, REX motions door status, door secure sensor will be provided under this section of the specification.

B. This section includes access control equipment consisting of door controller equipment connected to the network to operate the door access equipment.

C. The door control equipment and network will be connected to the access control server located in the building. The installation will consist of a software licenses and equipment. The contractor shall review the existing access control equipment and include any necessary equipment to maintain the intended design criteria.

D. The Access Control system shall be integrated with:

1. Fire Alarm System.

E. The integration of the above systems will include at a minimum data transfer of access card number, assigned card holder name and details, card holder photo, access permissions, schedule permissions, alarm inputs, video caption during alarms, fire alarm door release lockdown functions by door and groups of doors.

1. As part of this specification a factory trained certified integrator of the supplied equipment will work along with the owner representative, and the integrators of the other systems to provide:

    a. A SOP of the system operations.
    b. The system integrators will work together to integrate their system with the other specified systems to meet the SOP requirements.

1.7 SUBMITTALS

A. Product Data Sheets for each type of product indicated. Include dimensions and data features, performances, electrical characteristics, ratings, finishes, and manufacturer equipment warranty period.

B. Shop Drawings for the access control system including plans, elevations, sections, details and attachments to other work.

1. Detail equipment locations with specific equipment provided.
2. Functional Diagram Block showing single line connections between the access door hardware and the server equipment.
3. Dimensional plans of the equipment racks, control equipment, signal transmission along with service clearances.
4. UPS Power Feed and Back-up Power Calculations
5. UPS Dedicated circuit feed
6. Wire size calculations for each door cable run.

1.8 SPARE COMPONENTS

A. Provide the owner with 10% of the total number of door controllers for each type of controller that is provided by the Access Control Contractor under this project.

1.9 QUALITY ASSURANCE

A. Electrical components, devices, and accessories will be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for the intended location and application.

B. Comply with all laws, ordinances, rules, regulations and orders of public authorities having jurisdiction over this part of work. This includes but is not limited to having all necessary licenses, permits and inspections as required by local, state or federal authorities.

C. Access Control equipment standards: Electronic Industries Associations (EIA), IEEE. All equipment shall be listed and labeled as UL Listed and Approved to meet state electrical requirements.

D. Electronic data exchange of the access control software system shall utilize open architecture for the interface of video, input and output data transfer.

E. Installer Qualifications:

1. Security Systems Integrator must have personnel with a Certified Security Specialist Certification on staff and assigned to this project.
2. Security Systems Integrator must be an Authorized Dealer with the manufacturer of proposed system and certified on the equipment.
3. Within ten (10) business days of receiving the Notice to Proceed, the Integrator shall submit a list of all personnel assigned to the project. Identify their duties and their office address and telephone number.
4. Keep the job adequately staffed at all times. Unless illness, loss of personnel or other circumstances beyond the control of the contractor, maintain the same individual in charge throughout.
5. All work done under this contract shall be performed in accordance with the most recent issue of the Standard Building Code, The National Electrical Code (NFPA 70), and the National Electrical Safety Code (NESC) and any applicable local or state required codes and standards. Where there is a perceived conflict between a standard and the contract documents, the Contractor shall perform the work as directed by the Consultant. Where no specific method or form of construction is called for in the Contract Documents, the Contractor shall comply with code requirements when carrying out such work. Drawings pertaining to

this specification shall be considered as a part of said specification and shall be a part of the bid documents.

7. Procure and pay for all necessary permits, licenses and inspections and observe any requirements stipulated therein. Conform in all trades with all local regulations and codes.
8. Provide weekly status reports shall also be provided one day prior to the onsite project meetings starting after the Letter of Intent and continuing through project close-out. Reports shall be submitted electronically to the CM, Architect, and Consultant. It shall state project status in the field, scheduling, purchasing, and any concerns. It will not be a formal means of communication, and will not replace the requirement of RFIs, product submittals, proposed change orders, schedule issues, etc.

1.10 SYSTEM MANUFACTURER

A. Key Requirements:

1. All Products for Access Control System will match existing district wide system.

   Andover Continuum, by Schneider Electric

PART 2 – PRODUCTS

2.1 ACCESS CONTROL SYSTEM COMPONENTS

A. Card Readers, Keypads and Access Control Cards shall be provided in the encoding technology and quantities specified in the contract documents and drawings. Door contacts switches, request-to-exit devices, electric locks and strikes, local alarm horns, status indicators and other devices shall also be provide as shown on Contract Drawings

B. Readers:

1. Readers provide shall be HID technology
2. Quantity and location of readers shall be as specified in contract documents and drawings

C. Door Contact Switches:

1. Recessed Mount magnetic contact switches shall be provided to monitor the status of each card reader controller door and auxiliary door as noted on the contract drawings
2. Recessed devices shall be used where required
3. Quantity and location of the door contact switches shall be as specified in contract documents and drawings

D. Request-to-Exit Devices:

1. Request-to-exit devices shall be provided to allow a person to exit an access controlled door.
2. Quantity and location of request-to-exit devices shall be as specified in contract documents and drawings.

E. Electric Locking Devices:

1. Electric locking devices shall be provided to lock (secure) and unlock (unsecured) each card reader controlled door and auxiliary door as noted in the contract drawings
2. Electronic Locking Devices must be capable of being activated from the Networked Intelligent Controller
3. Door electric controlling devices shall be either Magnetic Locks or electric strikes as specified in contract documents and drawings
4. Quantity and location of electric locking devices shall be as specified in contract documents and drawings

2.2 MONITORING EQUIPMENT

A. Provide programming to interface to existing system.

2.3 NETWORK EQUIPMENT

A. See Section 27 of the Specifications and T-series drawings for device locations and quantities for the following:

1. Copper and Fiber outlets
2. Copper and Fiber cable, including patch cables
3. LAN POE Switches
4. Equipment Cabinets
5. System Application Computer and Server.

2.4 DOOR HARDWARE (See Section 8 of this Specification)

A. Exterior Panic Hardware Doors: (Door Type I):

1. Consists of panic hardware electronic
2. Shear Maglocks with door secure sensors

B. Interior Doors: (Door Type II):

1. Door strikes

C. Interior Doors: (Door Type (III):

1. 5/2 door electric hinge

2.5 ACCESS CONTROL EQUIPMENT

A. Lock Down Power Supply (Altronics):

1. Rack mounted standard EIA 19 rack-mount chassis
2. Allow RU space on top and bottom for ventilation
3. 6 amp 12 Vdc or 24Vdc is W16 of fused or PTC protected outputs
4. 115 VAC 50/60 Hz input

5. Individually selectable Fail Safe or Fail Secure power outputs
6. Fire Alarm disconnect input.

    a. With NO or NC dry contact input or polarity reversal input from FACP circuit. Fire Alarm disconnect is individually selectable for any or all of the outputs

7. AC fail supervision

B. HID i-Class Reader:

1. The card readers supplied for the access control portals will be HID i-class smart card readers transmitting a weigand output as follows:

    a. Standard Door Application: HID i-Class Model R40
    b. Mullen Door Application: HID i-Class Model R10
    c. Long Range Reader Application: HID i-Class Model R90 (up to 18")

2. No substitutions will be permitted.
3. Contactless smart card reader shall comply with the following 13.56 MHz related standards and ensure product compatibility with the access control system.

    a. ISO 15693
    b. ISO 14443A
    c. ISO 14443B

C. Door Status Sensors:

1. Equipment Design Criteria:

    a. The door status sensor shall be of a concealed recessed design that is compatible and operational with the access control door controller. It will function properly with the door and frame assembly without causing restriction of operation of the door or improper status or alarm signals.
    b. The door status sensor will be installed concealed in the door and door frame of each access control operated door assembly.
    c. Electrical Rating: The door status sensor will be listed and rated to operate with the access control door controller assembly.

D. REX Motion Detector:

1. Basis of Design: The REX motion, when required, will be connected to the door controller and mounted above the door that it is permitting exit to. It will be powered and controlled by the door controller.
2. The REX motion will be listed and rated for the location that it will be installed as follows:

    a. Indoor controlled environment
    b. Indoor uncontrolled environment
    c. Outdoor
    d. Hazardous location

3. Electrical Rating
   Power: The REX motion detector will match the door controller voltage and have an amp draw of less than .250 amps. The REX motion detector control voltage

and power shall be rated by the voltage and power provided by the door controller that it is being controlled by.

E. Shear Maglocks (Lockdown):

1. Basis for Design: Electromagnetic shear locks will be installed in all exterior doors and any other doors indicated on the drawing to have a lockdown function. The shear lock will be provided with a door lock sensor that will be connected to the door controller. The shear lock will be secured upon request of the Global Security Management Software.

2.6 OPERATIONAL OBJECTIVES

A. The Access Control System shall provide the following card access control operational objectives:

1. Controlled entry, via access card readers, of only authorized personnel to secured areas based on cardholder information entered and stored in the system database.
2. The access request response time from card presentation, database verification, to electric lock unlock shall be no more than one second in normal operating mode on a fully loaded system.
3. All access requests, both authorized and denied, shall be sent to the host for storage and annunciation, as required, with cardholder number, name, and access point/area where access was attempted or gained.
4. The software package shall provide for local Anti-Passback. The system shall also be capable of providing timed Local Anti-Passback for security areas, and the time shall be capable of being selected by the operator.
5. The system shall provide for automatic lock/unlock of access-controlled doors on a scheduled basis using time schedule.
6. Each card and cardholder shall be entered into the database prior to their use. Each card can be manually disabled at any time without the requirement to delete the card. Each card can then be subsequently re-enabled at a later time.
7. Cards records shall include the entry of activation and deactivation dates to provide for the automatic enabling and expiring of the card record.
8. The operating mode of access controlled doors shall be indicated as locked, unlocked, or controlled. The door status shall be indicated as open or closed.
9. The system shall provide for the monitoring of the reader controlled door position in order to detect and report Door Forced Open and Door Held Open alarm conditions. Door Held Open condition shall be based on a user-adjustable time period. The act of opening the door shall initiate the door timer, and also cause the immediate reset of the door lock.
10. The system shall provide the capability to unlock the door and/or mask (shunt) the door alarm, as user-configured, via a request-to-exit door motion sensor device or exit push-button. The capability shall be software programmable to allow selectable exit reporting.
11. All system controlled electric locks shall be capable of being unlocked via a client workstation and/or request-to-exit device.

B. Alarm Monitor Points:

1. Each supervised security system input point (door contacts, motion detectors, and other associated alarm inputs) shall have a user-specified 16 character, minimum, identifier.

2. The system shall allow masking and unmasking of alarm points manually by the operator, automatically by time schedule, or, where required, by a cardholder from a reader keypad. The system shall not allow an alarm point to be masked if the alarm point is in a “trouble” condition.
3. All alarm points shall be individually annunciated upon any change of state. Alarm contacts shall not be connected in parallel or series in zones, unless specifically shown on the contract drawings. Double doors with alarm contacts on each leaf of the double door unit may be wired in series, for that double door unit.
4. The system shall provide for special purpose alarm monitoring and/or transaction reporting for specific events, such as, but not limited to the following:

    a. Duress condition at a card reader
    b. Anti-Passback
    c. Rejected access request
    d. Card Reader Tampered
    e. Card reader Off-Line
    f. Controller Cabinet Tampered
    g. AC Power Failure
    h. Controller Communications Failure
    i. Low battery at UPS power supply

5. Unacknowledged alarm reports (an alarm condition that has not been acknowledged within a user-specified time period at a client workstation) shall initiate a Special alarm message to a designated alternate client workstation on the system.

C. Relay Output Points:

1. Each security system output point (door lock, gate controller, and other associated relay outputs) shall have a user-specified 16 character, minimum, text identifier. Each point shall be software programmable for activation and deactivation.
2. The system shall allow activation and deactivation of output points manually by the operator, automatically by time schedule, automatically by the activation of an alarm point.

2.7 CABLES

A. General Cable Requirements: Comply with specification requirements in Section 28 05 13 "Conductors and Cables for Electronic Safety and Security" and as recommended by system manufacturer for integration requirement.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine roughing-in for LAN and control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with recommendations in SIA CP-01.

B. Comply with TIA/EIA 606-A, "Administration Standard for Commercial Telecommunications Infrastructure."

C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Owner's requirements. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.

1. Record setup data for control station and workstations.
2. For each Location, record setup of controller features and access requirements.
3. Propose start and stop times for time zones and holidays, and match up access levels for doors.
4. Set up groups, facility codes, linking, and list inputs and outputs for each controller.
5. Assign action message names and compose messages.
6. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
7. Prepare and install alarm graphic maps.
8. Develop user-defined fields.
9. Develop screen layout formats.
10. Propose setups for guard tours and key control.
11. Discuss badge layout options; design badges.
12. Complete system diagnostics and operation verification.
13. Prepare a specific plan for system testing, startup, and demonstration.
14. Develop acceptance test concept and, on approval, develop specifics of the test.
15. Develop cable and asset-management system details.

D. In meetings with Architect and Owner, present Project planning documents and review, adjust, and prepare final documents. Use final documents to set up system software.

3.3 CABLING

A. Comply with NECA 1, "Good Workmanship in Electrical Construction."

B. Install cables and wiring according to requirements in Section 28 05 13 "Conductors and Cables for Electronic Safety and Security."

C. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.

D. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum

board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental airspaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

E. Install LAN cables using techniques, practices, and methods that are consistent with Category 6 rating of components and fiber-optic rating of components, and that ensure Category 6 and fiber-optic performance of completed and linked signal paths, end to end.

F. Boxes and enclosures containing security-system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

G. Install end-of-line resistors at the field device location and not at the controller or panel location.

3.4 CABLE APPLICATION

A. Comply with TIA 569-B, "Commercial Building Standard for Telecommunications Pathways and Spaces."

B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

C. TIA 232-F Cabling: Install at a maximum distance of 50 feet.

D. TIA 485-A Cabling: Install at a maximum distance of 4000 feet.

E. Card Readers and Keypads:

1. Install number of conductor pairs recommended by manufacturer for the functions specified.
2. Unless manufacturer recommends larger conductors, install No. 22 AWG wire if maximum distance from controller to the reader is 250 feet, and install No. 20 AWG wire if maximum distance is 500 feet.
3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the controller.
4. Install minimum No. 18 AWG shielded cable to readers and keypads that draw 50 mA or more.

F. Install minimum No. 16 AWG cable from controller to electrically powered locks. Do not exceed 250 feet.

G. Install minimum No. 18 AWG ac power wire from transformer to controller, with a maximum distance of 25 feet.

3.5 GROUNDING

A. Comply with Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."

C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

D. Bond shields and drain conductors to ground at only one point in each circuit.

E. Signal Ground:

1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
2. Bus: Mount on wall of main equipment room with standoff insulators.
3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.6 INSTALLATION

A. Install card readers, keypads, push buttons, and devices as indicated on the drawings.

3.7 SYSTEM SOFTWARE AND HARDWARE

A. Develop, install, and test software and hardware, and perform database tests for the complete and proper operation of systems involved. Assign software license to Owner.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 6 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA 568-B.1, "Commercial Building Telecommunications Cabling Standards - Part 1: General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA 568-B.1.
2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power-supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path

for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

C. Devices and circuits will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 DOCUMENTATION AND AS-BUILTS

A. As-Built record documentation for communications work shall include:

1. Cable routing and identification
2. End user outlet labeling
3. System function diagrams
4. Manufacturers' description literature for equipment
5. Connection and programming schedules as appropriate
6. Equipment material list including quantities
7. Spare parts list with quantities
8. Details not on original Contract Documents
9. Test results
10. Warranties
11. Release of liens

B. The Contractor shall provide and maintain at the site a set of prints on which shall be accurately shown the actual installation of all work under this section, indicating any variation from contract drawings, including changes in pathways, sizes, locations and dimensions. All changes shall be clearly and completely indicated as the work progresses.

C. Progress prints shall be available for inspection by the Owner or any of his representatives and may be used to determine the progress of communications infrastructure work.

D. At the completion of the work, prepare a new set of as-built drawings, of the work as actually noted on the marked-up prints, including the dimensioned location of all pathways.

E. Furnish as-built drawings and documentation to the Project Manager. As-built drawings shall be generated in AutoCad 2006 or later. Submit 3 copies of as-built drawings electronically on CD and hard copy.

3.10 OPERATIONS AND MAINTENANCE MANUAL

A. After completion of the work, the Contractor shall furnish and deliver to the Engineer three (3) copies of a complete Operations & Maintenance Manual. A system wiring diagram shall be furnished for each separate system.

B. The manual shall be subdivided into separate sections with tab dividers to identify subsystems of the integrated system. Reference appropriate Specification sections.

C. Provide the following additional information for each electronic system. Information shall be edited for this project where applicable.

1. Operations manuals for components and for systems as a whole.
2. Maintenance manuals for components and for system as a whole.
3. Point-to-point diagrams, cabling diagrams, construction details and cabling labeling details.
4. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
5. Emergency instructions for operational and maintenance requirements.
6. Delivery time frame for replacement of component parts from suppliers.
7. Recommended inspection schedule and procedures for components and for system as a whole.
8. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
9. Complete “reviewed” shop drawings and product data for components and system as a whole.
10. Troubleshooting procedures for each system and for each major system component.

3.11 STARTUP SERVICE

A. Engage a factory-authorized service representative to supervise and assist with startup service.

1. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.
2. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

3.12 PROTECTION

A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured with an activated burglar alarm and access-control system reporting to a central station complying with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.

3.13 TRAINING

A. The Contractor shall be responsible for training of facility personnel, See Section 01 79 00 "Demonstration and Training." Training shall take place after occupancy and before acceptance and shall include programs for on-site operations and maintenance of technology and communications systems.

B. Training shall be for not more than ten (10) people, shall be held at the Owner's site and shall be of sufficient duration and depth to ensure that the trained personnel can operate the installed systems and can perform usual and customary maintenance actions.

C. The contractor shall record the training and provide (3) DVD copies of the training to the project manager.

D. Develop separate training modules for the following:

1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.
3. Security personnel.
4. Hardware maintenance personnel.
5. Corporate management.

3.14 WARRANTY

A. General:

1. All equipment is to be new and warranted free of faulty workmanship and damage.
2. Replacement of defective equipment and materials and repair of faulty workmanship within 24 hours of notification, except emergency conditions (system failures), which must be placed back in service within eight (8) hours of notification, all at no cost to the Owner.
3. The minimum warranty provisions specified shall not diminish the terms of individual equipment manufacturer's warranties.

B. Access Control System:

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Access Control System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

3.15 IDENTIFICATION

A. In addition to requirements in this article, comply with applicable requirements in Section 26 05 53 "Identification for Electrical Systems" and Section 27 05 53 Identification for Communications Systems and with TIA/EIA 606-A.

B. Using software specified in "Cable and Asset Management Software" Article, develop cable administration drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with the same designation. Use logical and systematic designations for facility's architectural arrangement.

C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

D. At completion, cable and asset management software shall reflect as-built conditions.

END OF SECTION 28 13 00

SECTION 28 16 00
INTRUSION DETECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes intrusion detection with communication links to perform monitoring, alarm, and control functions.

1.3 REFERENCES

A. Underwriters Laboratories (UL):

1. UL 268 – Smoke Detectors for Fire Protective Signaling Systems
2. UL 365 – Police Station Connected Burglar Alarm Units and Systems
3. UL 609 – Local Burglar Alarm Units and Systems
4. UL 611 – Central Station Burglar-Alarm Units
5. UL 636 – Holdup Alarm Units and Systems
6. UL 684 – Local, Central Station, and Remote Station
7. UL 864 – Control Units for Fire Protective Signaling Systems
8. UL 985 – Household Fire Warning System Units
9. UL 1023 – Household Burglar-Alarm System Units
10. UL 1076 – Proprietary Burglar-Alarm Units and Systems
11. UL 1610 – Central-Station Burglar-Alarm Units

B. Federal Communications Commission (FCC):

1. Code of Federal Regulations Title 47 - Part 15 – Radio Frequency Devices.
2. Code of Federal Regulations Title 47 - Part 68 – Connection of Terminal Equipment to the Telephone Network.

C. National Fire Protection Association (NFPA):

1. NFPA70 – National Electrical Code.
2. NFPA 72 – National Fire Protection Code

1.3 SYSTEM DESCRIPTION

A. The system shall be a Burglary/Access Control/CCTV Switching System that includes the following capabilities:

1. Listed for UL Commercial Fire and Burglary.

2. Supports up to 250 zones.
3. Supports up to eight (8) separate partitions.
4. Supports up to 250 users.
5. Supports commercial wireless devices.
6. Provides integrated security, access control, and CCTV switching capability.
7. Provides supervision of peripheral devices.
8. Supports up to 96 optional relay outputs.
9. Supports long-range radio (LRR) communication.
10. Provides scheduling capability to allow for automated operations.
11. Supports up to eight (8) alphanumeric paging devices.
12. Supports panel linking.
13. Supports alarm reporting via Internet.
14. Interfaces with automation software.
15. Monitors smoke detector maintenance signals
16. Capable of being installed using existing wiring.

1.4 DEFINITIONS

A. Control Unit: System component that monitors inputs and controls outputs through various circuits.

B. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.

C. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.

D. Standard Intruder: A person who weighs 100 lb or less and whose height is 60 inches or less; dressed in a long-sleeved shirt, slacks, and shoes.

E. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.

1. Raceway Riser Diagrams: Detail raceway runs required for intrusion detection. Include designation of devices connected by raceway, raceway type and size, and type and size of wire and cable fill for each raceway run.
2. Site and Floor Plans: Indicate final outlet and device locations, routing of raceways, and cables inside and outside the building
3. Master Control-Unit Console Layout: Show required artwork and device identification.
4. Device Address List: Coordinate with final system programming.
5. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include

diagrams for equipment and for system with all terminals and interconnections identified.

6. Details of surge-protection devices and their installation.
7. Sensor detection patterns and adjustment ranges.

C. Equipment and System Operation Description: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are unacceptable.

D. Samples: For units with factory-applied color finishes.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Intrusion Detection Devices: Furnish quantity equal to five percent of the number of units of each type installed, but no fewer than one of each type.
2. Fuses: Three of each kind and size.
3. Tool Kit: Provide six sets of tools for use with security fasteners, each packaged in a compartmented kit configured for easy handling and storage.
4. Security Fasteners: Furnish no fewer than 1 box for every 50 boxes or fraction thereof, of each type and size of security fastener installed.

1.9 QUALITY ASSURANCE

A. Installer Qualifications:

1. An employer of workers, at least one of whom is a technician certified by the National Burglar & Fire Alarm Association.
2. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Control Units, Devices, and Communications with Monitoring Station: Listed and labeled by a qualified testing agency for compliance with SIA CP-01.

E. FM Global Compliance: FM-Approved and -labeled intrusion detection devices and equipment.

F. Comply with NFPA 70.

G. The alarm manufacturer shall be certified as being compliant with ISO9001.

1.10 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Altitude: Sea level to 4000 feet
2. Master Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F and a relative humidity of 20 to 80 percent, noncondensing.
3. Interior, Controlled Environment: System components, except master control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambients of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing.
4. Interior, Uncontrolled Environment: System components installed in non-air-conditioned interior environments shall be rated for continuous operation in ambients of 0 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing.
5. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambients of minus 30 to plus 122 deg F dry bulb and 20 to 90 percent relative humidity, condensing. Comply with UL 294 and UL 639 for outdoor-use equipment. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph.
6. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings shall be rated, listed, and installed according to NFPA 70.

1.11 SPECIAL REQUIREMENTS

A. The Security System herein specified shall be furnished by a licensed Security Alarm Systems installer who has been conducting business in Florida for at least three (3) years. A complete stock of parts for the systems furnished shall be in inventory at the local facilities of the supplier. The equipment manufacturer shall have service facilities within a fifty (100) mile radius with parts in stock and trained service personnel.

B. Trained service personnel shall be onsite within twenty-four (24) hours after receiving a service request during the warranty period, and onsite within four (4) hours for an emergency request.

C. For projects at existing sites, Contractor shall be responsible for maintaining existing system operation during all phases of construction, unless directed otherwise in writing by the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. Equipment shall consist of an Ademco Vista-250BPE (or current version) control panel with a fully-programmable alpha keypad, detection components, and all interconnections and accessories, wired in accordance with the manufacturer's instructions, the National Electrical Code, and industry standards, to make a complete and workable system.

2.2 SYSTEM PERFORMANCE

A. Control Panel: The control panel shall be an eight (8)-partition, UL commercial fire and burglary control panel that supports up to 250 zones using basic hardwired, polling loop, and wireless zones. It shall also provide supervision of two (2) notification appliance output circuits (NAC), RF receivers, and relay modules. In addition, the control shall provide the ability to schedule time-driven events, and allow certain operations to be automated by pressing a single button. The system shall be capable of interfacing with an ECP long range radio (LRR) unit that can send Contact ID messages, and alphanumeric paging devices. The control shall provide integrated access control and CCTV-switching capability with the use of a single downloader and database.

1. Basic Hardwired Zones - The control shall provide eight (8) style-B hardwire zones with the following characteristics:

a. EOLR supervision (optional for zones 2-8): Shall support N.O. or N.C. sensors (EOLR supervision required for UL installations).
b. Zones/Points shall be individually assignable to any partition.
c. Supports up to 64 two-wire smoke detectors on two selected zones.
d. Supports four-wire smoke or heat detectors on any zone (power to four-wire smoke detectors must be supervised with an EOL device).
e. Supports up to 50 two-wire latching glass break detectors on one selected zone.
f. Individually assignable to Notification Appliance (NAC) outputs and/or auxiliary relays.

2. Optional Expansion Zones:

a. Polling Loop Expansion – The control shall support up to 242 additional hardwire zones using a built-in two-wire polling (multiplex) loop interface. The polling loop shall provide power and data to remote point modules, and constantly monitor the status of all zones on the loop. Maximum current draw shall not exceed 128 mA. The polling loop zones shall have the following characteristics:

(1) Interface with RPM (Remote Point Module) devices that provide Class B, Style Y (e.g., 4208U/4208SN) or a combination of Class B, Style Y, and Class A, Style Z (e.g., 4208SNF) zones.
(2) Individually assignable to one of eight (8) partitions.
(3) Supervised by the control panel.
(4) A 12,000 ft (3658 m) wire run capability without using shielded cable.
(5) Each RPM (Remote Point Module) enclosure shall be tamper protected.

b. Wireless Expansion – The control shall support up to 250 wireless zones using a 5800 series RF receiver (fewer if using hardwire and/or polling loop zones). Wireless zones shall have the following characteristics:

(1) Supervised by control panel for check-in signals (except certain non-supervised transmitters).
(2) Tamper-protection for supervised zones.
(3) Individually assignable to one of eight (8) partitions.
(4) Individually assignable to bell outputs and/or auxiliary relays.
(5) Support wireless devices listed for Commercial Burglary using the 5881ENHC RF Receiver.

3. Partitions – The control shall provide the ability to operate eight (8) separate areas, each functioning as if it had its own control. Partitioning features shall include:

a. A Common Lobby partition (1-8), which can be programmed to perform the following functions:

(1) Arm automatically when the last partition that shares the common lobby is armed.
(2) Disarm when the first partition that shares the common lobby is disarmed.

b. A Master partition (9), used strictly to assign keypads for the purpose of viewing the status of all eight (8) partitions at the same time (master keypads).
c. Assignable by zone.
d. Assignable by keypad/annunciator.
e. Assignable by relay to one or all eight (8) partitions.
f. Ability to display fire and/or burglary and panic and/or trouble conditions at all other partitions' keypads (selectable option).
g. Certain system options selectable by partition, such as entry/exit delay and subscriber account number.

4. User Codes – The control shall accommodate 250 user codes, all of which can operate any or all partitions. Certain characteristics must be assigned to each user code, as follows:

a. Authority level (Master, Manager, or several other Operator levels). Each User Code (other than the installer code) shall be capable of being assigned the same or a different level of authority for each partition that it will operate.
b. Opening/Closing central station reporting option.
c. Specific partitions that the code can operate.
d. Global arming capability (ability to arm all partitions the code has access to in one command).
e. Use of an RF (button) to arm and disarm the system (RF key must first be enrolled into the system).

5. Peripheral Devices – The control shall support up to 30 addressable ECP devices, which can be any combination of keypads, RF receivers, relay modules, annunciator modules, and interactive phone modules. Peripheral devices have the following characteristics:

a. Each device set to an individual address according to the device's instructions.
b. Each device enabled in system programming.
c. Each device's address shall be supervisable (via a programming option).

6. Keypad/Annunciator – The control shall accommodate up to 16 keypads or six (6) touch-screen (i.e.; advanced user interface) keypads. The keypads shall be capable of the following:

   a. Performing all system arming functions.
   b. Being assigned to any partition.
   c. Providing four programmable single-button function keys, which can be used for:

      (1) Panic Functions –activated by wired and wireless keypads; reported separately by partition.
      (2) Keypad Macros –32 keypad macro commands per system (each macro is a series of keypad commands). Assignable to the A, B, C, and D keys by partition.

7. Optional Output Relays - A total of 96 relay outputs shall be accommodated using relay modules. Each relay module shall provide four (4) Form C (normally open and normally closed) relays for general-purpose use or two (2) Class-B, Style-Y supervised notification appliance circuit outputs, when using the 4204CF module. The relays shall be capable of being:

   a. Programmed to activate in response to system events.
   b. Programmed to activate using time intervals.
   c. Activated manually.
   d. Assigned an alpha descriptor.
   e. Used for Class B, Style-Y supervised bell outputs (4204CF module).
   f. A combination of 4204 (ECP) and 4101SN (polling loop) relays.

8. Optional Vista Interactive Phone Module – The control shall support the ADEMCO 4285/4286 VIP Modules, which permit access to the security system in order to perform the following functions:

   a. Obtain system status information.
   b. Arm and disarm the security system.
   c. Control relays.

9. Optional LED Annunciator – The control shall support the ADEMCO FSA-8 and FSA-24 annunciators, which are capable of:

   a. Visually identifying a zone or point that is in alarm or trouble.
   b. Programmable for system silence/reset.
   c. Up to 96 LEDs may be used in one system.
   d. A total of four (4) FSA-24 or 12 FSA-8 annunciators may be used in one system.
   e. An optional keyswitch, FSAKSM module, shall be available for UL listed Silence and Reset capability.

10. Notification Appliance Circuits (NAC) – The Control Panel shall internally provide two supervised NAC outputs for operating fire and burglar alarm notification

appliances. It shall also support additional supervised bell outputs when using 4204CF relay modules. Each NAC output shall be rated at 10-14 VDC, 1.7 amp max power limited. Total alarm current draw when using two NAC outputs shall not exceed 2.3 amps for battery independent operation.

11. Auxiliary Relay – A built-in Form C relay shall be provided. The relay contacts shall be rated at 28 VAC/VDC, 2.8 amps maximum. The relay shall support:

    a. Alarm activation.
    b. Trouble/supervisory activation.
    c. Reset of four-wire smoke detectors.
    d. Battery saving feature.

12. Integrated Access Control – The control shall be capable of the following:

    a. Providing a command that activates relays to allow access doors to open (e.g., lobby door), lights to be turned on or off, etc.
    b. Becoming a fully integrated access control system by using numerous VistaKey Single-Door Access Control Modules.
    c. Supporting up to 15 VistaKey Access Control Modules. The VistaKey Access Control Modules shall use the same Compass Downloader as the Vista-250BP and shall be programmable from the Compass Downloader or the Keypad/Annunciators.
    d. Assigning any number of access control relays to each partition (up to 96 for the system).
    e. Supporting up to 500 access card holders using VistaKey.
    f. Connecting to the ADEMCO PassPoint Access Control System via the Vista Gateway Module (VGM).

13. CCTV Switching – The System shall be capable of supporting the VistaView 100 CCTV Switching System. The CCTV system shall be fully integrated and be event driven by Fire, Burglary or Access events. When cameras are not event driven, they shall be driven by an automatic preset dwell time. The system shall also be capable of:

    a. Activating the CCTV system via a Form-C relay output.
    b. Operating up to 60 camera inputs and 30 video outputs.

14. Commercial Wireless Equipment – The Control shall be compatible with UL Listed Commercial Wireless Fire & Security equipment including:

    a. ADEMCO 5881ENHC Commercial Fire/Burg Receiver. - The receiver shall be capable of receiving as many points as the control panel is rated for. Up to two (2) Receivers may be used on any system. Receivers may be remotely located anywhere on the system Keypad/Annunciator bus.
    b. ADEMCO 5808LST Wireless Photoelectric Smoke and Heat Detector - The device shall be UL 268 listed and shall have Maintenance Alert capability and Automatic Drift Compensation.
    c. ADEMCO 5809 Wireless 135D Fixed Temperature and Rate of Rise Heat Detector - The device shall be UL 521 listed for commercial applications.
    d. ADEMCO 5817CB Wireless Universal Contact Monitoring Transmitter - This device shall be capable of making any conventional UL listed contact device a wireless device. The device shall be UL listed for

commercial fire and burglary applications as follows: UL 864, 985 for fire and UL 365, 609, 1023, 1076 and 1610 for security and nurse call.

e. ADEMCO 5869 Wireless Hold Up Switch/Transmitter - This device shall be UL 636 listed for commercial burglary applications.

15. Optional Keyswitch – The control shall support the ADEMCO 4146 Keyswitch on any one of the system's 8 partitions. If used, zone 7 is no longer available as a protection zone.
16. Voltage Triggers – The system shall provide voltage triggers, which change state for different conditions. Used with LRR (Long Range Radio) equipment or other devices such as a remote keypad sounder, keyswitch ARMED and READY LEDs, or a printer to print the system's event log.
17. Event Log – The System shall maintain a log of different event types (enabled in programming). The event log shall provide the following characteristics:

    a. Stories up to 1,000 events.
    b. Viewable at the keypad or through the use of Compass software.
    c. Printable on a serial printer using a 4100SM Module including zone alpha descriptors.
    d. Stores PassPoint access control events.
    e. Sends printed events to up to eight alpha numeric pagers.

18. Scheduling - Provides the following scheduling capabilities:

    a. Open/close schedules (for control of arming/disarming and reporting).
    b. Holiday schedules (allows different time windows for open/close schedules).
    c. Timed events (for activation of relays, auto-bypassing and un-bypassing, auto-arming and disarming, etc.).
    d. Access schedules (for limiting system access to users by time)
    e. End User Output Programming Mode (provides 20 timers for relay control).
    f. The system shall automatically adjust for daylight savings time.

19. Communication Features - Supports the following formats and features for the primary and secondary central station receivers:

    a. Formats:

        (1) ADEMCO Low Speed (Standard or Expanded).
        (2) Sescoa/Radionics.
        (3) ADEMCO Express.
        (4) ADEMCO High Speed.
        (5) ADEMCO Contact ID.

    b. Backup reporting – The system shall support backup reporting via the following:

        (1) Secondary phone number.
        (2) ECP long-range radio (LRR) interface.
        (3) Option to select long range radio (LRR) or dialup as the primary reporting method (dynamic signaling feature).

    c. Internet reporting – The system shall be capable of communicating with the central station via the internet using Alarmnet-i. It shall provide the

user with the ability to control the system via a browser interface (i.e., AOL, Netscape, Internet Explorer). All packet data transmitted to the monitoring station shall be encrypted with a minimum of 1024 bits of encryption.

20. Audio Alarm Verification Option - Provides a programmable Audio Alarm Verification (AAV) option that can be used in conjunction with an output relay to permit voice dialog between an operator at the central station and a person at the premises.
21. Cross-Zoning Capability - Helps prevent false alarms by preventing a zone from going into alarm unless its cross-zone is also faulted within 5 minutes.
22. Pager Interface – The Control Panel shall be capable of sending event information to an alphanumeric pager via a pager interface device.
23. 24-Volt Power Supply – The Control Panel shall be compatible with a 24-Volt power supply module. The module shall supply two (2) 24 vdc, 3.4 amps, rectified, unfiltered outputs, which power:

    a. Alarm notification appliances, including but not limited to sirens horns, bells and strobes.
    b. Auxiliary devices capable of operating using full-wave rectified unfiltered voltage.

24. Exit Error False Alarm Prevention Feature – The System shall be capable of differentiating between an actual alarm and an alarm caused by leaving an entry/exit door open. If not subsequently disarmed, the control panel shall:

    a. Bypass the faulted E/E zone(s) and/or interior zones and arm the system.
    b. Generate an Exit Error report by user and by zone so the central station knows it was an exit alarm and who caused it.

25. Enhanced Fire Walk-Test Mode – The Control Panel shall provide the installer with the following features:

    a. Automatic test of all integrated remote point module (RPM) devices, equipped with an automatic test feature.
    b. While automatic test is in progress all fire zones that remain untested shall be displayed.
    c. An event log shall be capable of logging the results of tested and untested zones.
    d. The ability to report the result of tested and untested zones to the central station.

26. Built-in User's Manual and Descriptor Review - For end-user convenience, the control panel shall contain a built-in User’s Manual. It shall include the following capabilities:

    a. By depressing any of the function keys on the keypad for five (5) seconds, a brief explanation of that function shall scroll across the alphanumeric display.
    b. By depressing the READY key for five (5) seconds, all programmed zone descriptors shall be displayed (one at a time). This feature shall provide a check for installers and ensure all descriptors have been entered properly.

27. Programming - The Control shall be capable of being programmed locally or remotely using the ADEMCO Compass Downloader and shall be capable of:

    a. Uploading and downloading all programming information at 300 baud.
    b. Uploading and displaying firmware revision levels from the control.

28. Panel Linking - The Control shall be capable of being networked together with up to eight other controls and being operated by any keypad within the system. It shall provide the ability for users to:

    a. Control multiple zones, partitions, and/or buildings from a central location.
    b. Check status, arm and disarm any partition from any keypad in the system.
    c. Globally arm or disarm partitions based upon user authority.

29. Automation Software - The Control shall be capable of interfacing with automation software via an RS232 input on a single partition.

2.3 CONTROL UNIT

A. The control unit shall be an Ademco Vista-250BPE (or current version) system consisting of the following:

1. Ademco Vista-250BPE panel
2. Ademco 6160 keypad/Control Console
3. Ademco 4219 zone expander panel (if required, installed in separate panel box, with auxiliary 12vdc power supply, & 12v, 4AH battery.)
4. YUASA NP7-12 12Volt 7AH battery
5. DITEK MRJ31X surge protector
6. RJ45 Network interface
7. RJ31X phone jack
8. Telephone cord

B. The control unit shall be mounted in a Square “D” flush mounted cabinet when located in occupied areas such as the Kitchen Office. All other panels are to be located in electrical or communications rooms in a surface mounted Square “D” cabinet. The cabinet shall be labeled “SECURITY SYSTEM”.

C. The keypad shall be mounted on the wall next to the control panel. (Unless otherwise directed by the Owner.)

2.4 DETECTION DEVICES

A. Door contact: Roller type door contact with reed plunge switch in an epoxy housing shall be used. The contact shall have a .050” thick mounting flange. Roller travel shall be 7/32”. Leads shall be PVC insulated, 22 gauge, and a minimum of seven (7) inches long (Sentrol 3005 series or pre-approved equal). Switch configuration and color shall be field verified and coordinated with A/E and owner. Mount contact in drilled ¾” hole after doorframes are painted. Contact shall be installed using #4 screws that finish flush (or are countersunk) into the mounting flange upon installation. Rivets shall not be used. Provide handy box and in-wall conduit to junction box above the ceiling. Provide a minimum of eighteen (18) inches of slack wire in junction box above ceiling. Provide sufficient service loop for removal of contact for maintenance.

B. Motion Detectors:

1. Motion detectors shall provide uniform detection capability throughout pattern, with optimum field of view for man-size targets. Dynamic Data Discrimination Signal processing shall be used to reduce the likelihood of false alarms caused by rapid temperature change of a fixed object. An LED on the device shall indicate when it is in alarm condition. Field coordinate exact configuration with the Owner.
2. Long-range motion detectors shall be the same as item “a” except shall be capable of providing coverage up to eighty (80) feet from the sensor. (Honeywell, GE Sentrol SR-AP633A or equal as pre-approved by Owner.)
3. Single mounted 360-degree detectors shall use dual technologies, microwave and infrared (PIR) in configuration where both must detect intrusion before an alarm is generated. Microwave detector shall follow PIR detector. Microwave shall remain idle until PIR senses a change in ambient temperature. Once temperature change is detected, microwave shall activate to verify alarm condition. Device shall be mounted in the center of the room, away from active air vents, but still capable of detecting intrusion at the windows and doors, and no higher than nine (9) feet. (Honeywell, RISCO RK150T, CROW SRX-360, or equal as pre-approved by Owner, with sensitivity properly adjusted to provide the acceptable protection required in a given area.)
4. Curtain detector shall sense changes in the level of infrared radiation within their field of detection. Balanced detection feature shall reduce the likelihood of false alarms caused by events such as rapid temperature change in a fixed object. An LED on the device shall indicate when it is in an alarm condition Coordinate exact configuration and mounting type (flush or surface) with the A/E. (Honeywell, GE Sentrol 6155 Sharpshooter with curtain lens or equal as pre-approved by Owner.)
5. Use appropriate devices for coverage of large areas: Media centers, Cafeterias, Auditoriums, All Purpose Rooms and rooms with ceilings higher than (9) feet. (Honeywell CK-DT6360STC (for 360-degree), GE Sentrol SR-AP633A or equal as pre-approved by Owner, with sensitivity properly adjusted to provide the acceptable protection required in a given area.)

2.5 WIRING

A. Conduit and Conductors: Provide complete wiring and conduit between all equipment. Wiring shall be Genesis Cable Systems WG-11135509 (or pre-approved equal) for feeder cable and Genesis Cable Systems WG-11041101 (or pre-approved equal) for device cable installed in separate conduit, maximum forty percent (40%) full. Conduits of proper size shall be installed from the Control Panel Equipment to field devices. All field devices shall be mounted upon U.L. listed electrical junction boxes. All splices in field wiring shall be made in U.L. listed electrical junction boxes. All electrical junction boxes shall be labeled “SECURITY SYSTEM” with decal or other approved markings. The Security System Installation shall comply fully with all Local, State, and National Codes, and the Local Authority Having Jurisdiction (AHJ).

1. Wiring shall be color coded as follows:

a. Device Cable:

1)	Black	Negative
2)	Red	Positive
3)	Green/White	Loop

b. Feeder Cable:

1)	Black	Negative

2)	Red	Positive
3)	Green/White	Loop 1
4)	Orange/Blue	Loop 2
5)	Yellow/Brown	Loop 3
6)	Pink/Tan	Loop 4
7)	Gray/Purple	Loop 5

2.6 ELECTRICAL POWER REQUIREMENTS

A. The Burglary Alarm System shall operate on standard 120 volt AC, 50/60 Hz power. Provide a duplex power outlet, a building ground connection, and a telephone line terminated on an RJ31X connector inside the Square “D” box, but *outside* the control panel at each control panel.

1. The duplex outlet shall be installed so as to allow the transformer to be attached and still close the door of the Square “D” box.
2. The ground wire shall be green in color and a minimum of #6 AWG wire terminated on a barrier strip inside the Square “D” box and properly connected to the security panel, expansion module, and the telephone line surge protector.
3. The telephone line shall be connected to the CO line to seize the line *in front* of the Telephone KSU system, but still allow the line to be used by the Telephone KSU system when not in use by the Security System. The line shall *not* be connected to any *incoming telephone* line. The line shall be *connected to out-dial lines only*. Each panel shall be connected to a separate telephone line where possible.
4. Control Primary Transformer power shall be 18 VAC, 72VA.
5. A rechargeable 12 VDC, gel type, lead acid backup battery shall be provided. The battery shall be rated between 7 and 34-ampere hours (AH).
6. Alarm power shall be 10 - 13.8 VDC, 1.7 amps for each bell output
7. Auxiliary Standby power shall be 9.6 - 13.8 VDC, 1 amp maximum.
8. Fusing – The battery input, auxiliary, and bell outputs shall be protected using PTC circuit breakers. All outputs shall be power limited.

B. Provide a normally closed circuit to the existing Knox Key-Vault to be connected to the internal switch of the key-vault.

C. Provide a normally open circuit to the Fire Alarm Control Panel to be connected by the Fire Alarm Subcontractor to the Fire Alarm Control Panel.

D. EMI/Lightning Protection: Provide adequate transient voltage/surge suppression on all power and signal circuits at each entry and exit of a building and at the main Security Control Panel.

2.7 RACEWAYS AND FITTINGS

A. Electric Metallic Tubing (EMT) may be installed in interior locations only, with locknuts, bushings, and other fittings tight compression type. Elsewhere, conduit shall be hot dip galvanized rigid steel (or PVC if below grade). PVC conduit is acceptable in exterior enclosed canopies only. PVC shall not be installed inside buildings.

B. For replacement of an existing Security System, conduit may be reused if of adequate diameter and only new conductors for Security System are run within same conduit.

Remove all existing wiring from used conduit and clean interior. Additional supports shall be added to be comparable to that specified for new conduit.

2.8 ENVIRONMENTAL CONDITIONS

A. Environmental Conditions – The Fire and Burglary Alarm System shall be designed to meet the following environmental conditions.

1. Storage Temperature – The system shall be designed for a storage temperature of -10° C to 70°C (14° F to 158°F).
2. Operating Temperature - The system shall be designed for an operating temperature of 0° C to 50°C (32° F to 120°F).
3. Humidity - The system shall be designed for normal operation in an 85% relative humidity environment.
4. Electromagnetic Interference – The system shall meet or exceed the requirements of FCC Part 15, Class B devices, FCC Part 68, IEC EMC directive.

PART 3 - EXECUTION

3.1 SYSTEM INSTALLATION

A. Comply with UL 681 and NFPA 731.

B. Equipment Mounting: Install master control unit on finished floor with tops of cabinets not more than 72 inches above the finished floor.

C. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

D. Connecting to Existing Equipment: Verify that existing perimeter security system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the Supervising Station.
3. Expand, modify, and supplement existing control equipment as necessary to extend existing monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

E. Security Fasteners: Where accessible to inmates, install intrusion detection components using security fasteners with head style appropriate for fabrication requirements, strength, and finish of adjacent materials except that a maximum of two different sets of tools shall be required to operate security fasteners for Project. Provide stainless-steel security fasteners in stainless-steel materials.

3.2 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceways according to Division 26 Section "Raceway and Boxes for Electrical Systems." Conceal raceway except in unfinished spaces and as indicated.

Minimum conduit size shall be 1/2 inch. Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Wiring Method: Install wiring in metal raceways according to Division 26 Section "Raceway and Boxes for Electrical Systems," except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch. Control and data transmission wiring shall not share conduit with other building wiring systems.

C. Wiring Method: Cable, concealed in accessible ceilings, walls, and floors when possible.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Wires and Cables:

1. Conductors: Size as recommended in writing by system manufacturer unless otherwise indicated.
2. 120-V Power Wiring: Install according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.

F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

G. Install power supplies and other auxiliary components for detection devices at control units unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.

H. Identify components with engraved, laminated-plastic or metal nameplate for master control unit and each terminal cabinet, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with identification requirements in Division 26 Section "Identification for Electrical Systems."

B. Install instructions frame in a location visible from master control unit.

3.4 GROUNDING

A. Ground the master control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to master control unit.

B. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

C. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5-ohm ground. Measure, record, and report ground resistance.

D. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

1. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. System Programming: C&E Maintenance shall complete final programming, once notified that the system is fully wired (all zones properly terminated on the panel), each zone labeled, and fully “walk” tested.

C. Tests and Inspections: Comply with provisions in NFPA 731, Ch. 9, "Testing and Inspections."

1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
2. Test Methods: Intrusion detection systems and other systems and equipment that are associated with detection and accessory equipment shall be tested according to Table "Test Methods" and Table "Test Methods of Initiating Devices."

D. Documentation: Comply with provisions in NFPA 731, Ch. 4, "Documentation."

E. Provide Owner with three (3) copies, in CD-ROM format, of the following:

1. Operating Manual
2. Service Manual
3. Technical Manuals and Schematics
4. Maintenance Instructions
5. Parts Listings
6. As-built drawings indicating each security device, labeled by panel and zone. (three (3) copies per security panel)
7. Software interface (with any required hardware interfaces between a laptop computer and control panel) with a copy of the final program.
8. Operating instructions and demonstration for staff.

F. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.

G. Each burglar alarm zone shall be labeled so as to indicate each area that is connected to that burglar alarm zone (i.e., Burglar Alarm Zone 1 – Rooms 101, 102, 103, 104; Burglar Alarm Zone 2 – Rooms 105, 106; etc.). These labels shall be located on both the panel and the corresponding cable. Refer to single line for zoning requirements.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the intrusion detection system. Comply with documentation provisions in NFPA 731, Ch. 4, "Documentation and User Training." Provide the minimum number of hours of technical training for two (2) of the Owner's technicians to become factory certified in the maintenance of this system, at no additional expense to Owner.

3.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of intrusion detection devices and equipment that fails in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

END OF SECTION 28 16 00

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SECTION 28 23 00
CCTV AND VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. This document describes the products and execution requirements relating to the Security CCTV and Video Surveillance System.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

D. Related Specifications:

1. Division 00
2. Division 01
3. Division 27
4. Division 28

E. Applicable requirements of the Division 27 and 28 Design Criteria shall all be considered a part of this Division and shall have the same force as if written herein full.

1.2 SUMMARY

A. This document describes the equipment and execution requirements relating to the Security CCTV and Video Surveillance System.

B. In general, you will be known throughout the documents as “Video Surveillance System contractor, CCTV or VSS Installer, CCTV or VSS integrator, or the Owner’s Vendor.”

C. The installation shall include all accessories and appurtenances required to provide a complete and fully operational system. Any materials not specifically mentioned in these specifications, but required for a finished and functional installation shall be furnished and installed at no additional cost to the Owner. Provide all items not indicated on the drawings or mentioned in the specifications that are necessary, required or appropriate for this work to provide complete, stable and safe operation.

D. All equipment shall be installed as shown on the drawings and in strict accordance with the specifications. Any errors, conflicts, or omissions discovered in the specifications or the drawings shall be submitted in writing to the engineer for clarification. Installation shall not proceed until questions have been resolved.

E. The contractor shall deliver, install, program, test, start-up, checkout and otherwise substantially complete the systems within the Construction Manager’s construction schedule. The system shall be available for a substantial completion inspection by the Owner and the Consultant on the scheduled substantial completion inspection date.

1.3 WORK INCLUDED

A. The work to be done under this section of the Specifications shall include the furnishing of labor, material, equipment and tools required for the complete installation of the work indicated on the Drawings or as specified herein.

B. All materials, obviously a part of the Security Infrastructure and necessary to its proper operation, but not specifically mentioned or shown on the Drawings, shall be furnished and installed without additional charge.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the engineer shall be notified of the discrepancy.

D. The Contractor shall be responsible for full coordination of all work to be accomplished as part of the Security CCTV and Video Surveillance System project as well as all programming to interface to existing campus wide system.

1.4 QUALITY ASSURANCE

A. Comply with all laws, ordinances, rules, regulations and orders of public authorities having jurisdiction over this part of work. This includes but is not limited to having all necessary licenses, permits and inspections as required by local, state or federal authorities.

B. Video Surveillance equipment standards: Electronic Industries Associations (EIA), IEEE. All equipment shall be listed and labeled as UL Listed and Approved to meet state electrical requirements.

1.5 SYSTEM MANUFACTURER

A. Key Requirements:

1. All Products for Video Surveillance System will match existing system, unless otherwise specified by owner.

   Manufacturer – Honeywell Prowatch.

B. Manufacturer Warranty and Support:

1. Manufacturer shall provide technical support at no charge to assist owner's request
2. Manufacturer shall offer a three year warranty on all products except digital recorders, which shall be one year.
3. Warranty for equipment shall begin at the time of equipment installation, and not the ship date of equipment.
4. Manufacturer shall offer immediate Advance Replacements of warranty items at no additional charge.

PART 2 – PRODUCTS

2.1 GENERAL

A. Acceptable Manufacturer: Match existing on site system components.

2.2 CONTROL UNIT AND PANELS

A. The control unit/software shall be mounted in the Control Room. Termination Panels shall be mounted in the Building MDF as shown on the drawings. The cabinet or panels shall be labeled “VIDEO SURVEILLANCE SYSTEM”.

2.3 SYSTEM DEVICES

A. See drawings for types, requirements and locations.

2.4 VIDEO SURVEILLANCE SYSTEM OPERATION

A. Provide new PTZ or Fixed color camera locations as shown on drawings, with head-end equipment located in the CCC Building MDF equipment cabinets.

B. Cameras shall be positioned according to drawings for best coverage of the intended area.

C. Head-end equipment shall be positioned according to drawings in a logical manor.

D. Wire and cable for each camera location shall be carefully installed to ensure that all state and local low voltage electrical codes and wiring requirements are strictly followed. Contractor shall be responsible for confirming and following all state and local electrical code requirements. Any deviation from state or local electrical code requirements shall be repaired at contractor’s expense. All power and video cable, and wire shall be installed according to state electrical code.

E. Contractor to provide ten (10) feet of extra power and video wire at both ends. All wire and cable shall be neatly dressed and tie wrapped. All wire and cable shall be terminated directly into head-end equipment with no splicing or patching.

F. As code allows, all above ceiling, secure, and exposed wire and cable shall be run without conduit and shall be considered “open cabling”. Plenum cable shall be required as low voltage electrical code dictates; otherwise non-plenum cable is acceptable. All open, non-secured, easily accessible, and visible wire and cable shall be installed in conduit and wire-mold according to codes and electrical laws.

G. The scope of the work may include a combination of the following listed equipment: new interior and exterior color fixed camera locations, new interior and exterior PTZ dome camera locations, digital recording and control system programming.

H. Installation Requirements – Install CCTV equipment with all power supplies, terminal strips, cable and other equipment as required for a complete and operating system. All programming and preliminary testing to be accomplished at the shop. Follow installation procedures and wiring recommendations of the equipment manufacturer.

I. Testing Requirements – The contractor shall perform all electrical and mechanical tests recommended by the equipment manufacturer and required in this section. Bench settings are not acceptable. Final tests and inspection shall be held in the presence of the owner.

J. Training Requirements – Provide eight hours of training of operational instruction and four hours of maintenance instruction. Seminars to be “hand on” instruction held at facility.

K. ALL cameras will be 24/7 monitoring. The recordings will be capable of storage for 7 days.

2.5 CABLE, WIRE, AND ACCESSORIES

A. Copper:

1. Homerun from each Camera to the MDF or IDF room as shown on the drawings.

B. UTP Cable shall be the same cable as the Data and Voice cabling.

PART 3 – EXECUTION

3.1 SYSTEM INSTALLATION

A. Comply with OSHA, UL 681 and NFPA 731.

B. Wall mounted in the MDF as necessary to connect to system devices. The equipment shall be installed within the MDF spaces in a logical manner.

C. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor, AFF.

D. MDF:

1. Equipment layout by Owner’s Vendor. MDF Equipment Cabinet provided by Division 27 Contractor.
2. Contractor shall terminate all cameras jacks together starting at bottom patch panel, port 48 and work backwards. Label each port as “Camera #”.

3.2 RACEWAYS AND FITTINGS

A. Electric Metallic Tubing (EMT) may be installed in interior locations only. Locknuts, bushings, and other fittings tight compression type. Below grade and in concealed locations above grade, conduit shall be either hot dip galvanized rigid steel or PVC with rigid steel elbows. PVC shall not be installed inside buildings.

B. Underground conduit shall be installed a minimum of 2’-0” below grade.

3.3 SYSTEM TEST

A. Upon completion of installation of system specified, cameras shall be completely verified and tested in the presence of the installing contractor and owner's representative by a factory-authorized representative. Results of the verification and testing shall be reported in writing to the A/E. The review and acceptance of the written report shall be a prerequisite for the acceptance of the work.

B. Provide close-out documents and Owner training, in accordance with the close-out requirements specified elsewhere, to include the following:

1. Operating Manual
2. Service Manual
3. Technical Manuals and Schematics
4. Maintenance Instructions
5. Parts Listings
6. As-Built Drawings
7. Software interface (with any required hardware interfaces between a laptop computer and control panel) with a copy of the final program
8. Operating instructions and demonstration for staff
9. The minimum number of hours of technical training for two (2) of the Owner's technicians to become factory certified in the maintenance of this system at no additional expense to the Owner.

3.4 TRAINING

A. The VSS Installer shall provide on-site training to the owners on-site and technical personnel on the operational use of the features of the system and the use of all equipment provided. The cost of training shall be included in the bid. The Owner's staff and the Consultant shall be notified prior to and may participate in training at their discretion. The VSS Installer shall provide documentation of training including names of personnel present at each training session to the Consultant prior to final acceptance.

B. Training shall include a "walk-through" of the system for location and orientation, a discussion of overall system concepts and configuration, a review of the as-built drawings, a review of the system verification and acceptance documentation, and guidelines for operation and basic trouble-shooting of the System.

C. System training shall be presented in an organized and professional manner by a technician who is thoroughly familiar with the system installation for this project.

D. System training shall be conducted during regular working hours and at a time suitable to the Owner. The instructor shall provide operations manuals or any other instructional material that may enhance the training effort. The VSS Installer shall provide all material and equipment necessary to perform the training and shall utilize actual equipment in operation.

E. Video record all training sessions and deliver the electronic file to the owner (for future training).

F. After the Owner has utilized the facility for two months, follow up training shall be scheduled to resolve any questions or system functions.

3.5 WARRANTY

A. All components, parts, and assemblies supplied by the manufacturers and installed by the Contractor shall be warranted against defects in material and workmanship for a period of at least 12 months (parts and labor), commencing upon date of acceptance by Owner. A qualified factory-trained service representative shall provide warranty service.

B. Service/Maintenance:

1. System maintenance and repair of system or workmanship defects during the warranty period shall be provided by the Contractor free of charge (parts and labor).
2. Periodic testing of the system shall be carried out on a monthly or quarterly basis to ensure the integrity of the control panel, the sensing devices, and the telephone lines.
3. The installer shall correct any system defect within six hours of receipt of call from the Owner.
4. Extended service/maintenance agreements shall be offered by the Contractor for up to four years after the warranty expires. The agreement shall be renewable monthly, quarterly, or yearly.

C. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of intrusion detection devices and equipment that fails in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

3.6 CLOSEOUT DOCUMENTATION

A. Operation and Maintenance Manuals:

1. Quantity: Three (3) or greater quantity if required by the architectural specifications.
2. Provide O&M Manuals as required by the architectural specifications and as follows.

a. The O&M Manuals shall contain sufficient information to permit Owner personnel to operate the system with or without assistance from the Contractor.
b. The Contractor shall provide O&M Manuals covering all equipment and materials furnished under this contract.
c . The O&M Manuals shall contain all information necessary for the operation, maintenance, parts procurement, and parts replacement for the Video Surveillance system.

3. Sections: All sections shall be separated with an appropriate tabbed section divider with the appropriate number and title (typed) as follows:

a. Section 1 Cuts Sheets: Manufacturer’s original data/cut sheets for each system component.
b. Section 2 Equipment List: Typed list of each item of electrical, active equipment provided with system with brief description, serial number, and part number. Note where each item of equipment is installed (i.e. in which room or area, etc.).

c. Section 3 Factory Manuals: Manufacturer's printed Installation and Operating Manuals for each item of equipment.
d. Section 4 Warranties: Copy of Contractor's warranty.
e. Section 5 Cable Tests: All tests results for all cabling.
f. Section 6 Commissioning: All tests results.

END OF SECTION 28 23 00

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SECTION 28 31 11
DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Magnetic door holders.
7. Remote annunciator.
8. Addressable interface device.
9. Digital alarm communicator transmitter.
10. System printer.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Noncoded UL-certified addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire-alarm system design.
b. NICET-certified fire-alarm technician, Level III minimum.
c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

E. Qualification Data: For qualified Installer.

F. Field quality-control reports.

G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

H. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

G. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FMG-approved alarm company.

1.7 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Subject to compliance with requirements, provide Notifier Onyx Series NFS2-3030 Networked System or comparable product by one of the following:

1. Fire-Lite; a Honeywell company.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Flame detectors.
4. Smoke detectors.
5. Duct smoke detectors.
6. Verified automatic alarm operation of smoke detectors.
7. Automatic sprinkler system water flow.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
9. Activate emergency lighting control.
10. Activate emergency shutoffs for gas and fuel supplies.
11. Record events in the system memory.
12. Record events by the system printer.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Elevator shunt-trip supervision.
3. Duct smoke detector operation.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.

8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

    a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
    b. Include a real-time clock for time annotation of events on the event recorder and printer.

2. Addressable initiation devices that communicate device identity and status.

    a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
    b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 40 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.

    a. Initiating Device Circuits: Style D.
    b. Notification Appliance Circuits: Style Z.
    c. Signaling Line Circuits: Style 7.
    d. Install no more than 50 addressable devices on each signaling line circuit.

2. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.

    a. Initiating Device Circuits: Style B.
    b. Notification Appliance Circuits: Style Y.
    c. Signaling Line Circuits: Style 0.5.
    d. Install no more than 50 addressable devices on each signaling line circuit.

3. Serial Interfaces: Two RS-232 ports for printers.

D. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

E. Notification Appliance Circuit: Operation shall sound in a temporal pattern.

F. Elevator Recall:

1. Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall.

    a. Elevator lobby detectors except the lobby detector on the designated floor.
    b. Smoke detector in elevator machine room.
    c. Smoke detectors in elevator hoistway.

2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

    a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

G. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

J. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire-alarm control unit.

1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.

a. Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
b. Programmable tone and message sequence selection.
c. Standard digitally recorded messages for "Evacuation" and "All Clear."
d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.

2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

K. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

L. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

M. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed, valve-regulated, recombinant lead acid.

N. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
    b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
    c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

E. Single-Station Duct Smoke Detectors:

1. Comply with UL 268A; operating at 120-V ac.
2. Sensor: LED or infrared light source with matching silicon-cell receiver.

    a. Detector Sensitivity: Smoke obscuration between 2.5 and 3.5 percent/foot when tested according to UL 268A.

3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. The fixed base shall be designed for mounting directly to air duct. Provide terminals in the fixed base for connection to building wiring.

    a. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.

4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
5. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.

B. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

D. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output:

a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, white.

E. Voice/Tone Notification Appliances:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
2. High-Range Units: Rated 2 to 15 W.
3. Low-Range Units: Rated 1 to 2 W.
4. Mounting: Flush.
5. Matching Transformers: Tap range matched to acoustical environment of speaker location.
6. Manufacturer: Wheellock

a. Low-range units: ET70 series.
b. High range units: ET90 series

F. Voice Speaker Clusters:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
2. Speaker Units: Rated 15 to 30 W. per unit
3. Mounting: Pendant
4. Matching Transformers: Tap range matched to acoustical environment of speaker location.

5. Strobes: 177 cd
6. Manufacturer: Wheellock Series STH

2.8 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.
4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.9 REMOTE ANNUNCIATORS

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to circuit-breaker shunt trip for power shutdown.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.12 SYSTEM PRINTER

A. Printer shall be listed and labeled by an NRTL as an integral part of fire-alarm system.

2.13 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, or other device requiring protection.

1. Factory fabricated and furnished by manufacturer of device.
2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Wiring Methods:

1. Enclose all wiring in metallic raceway within buildings and structures.
2. Refer to Section RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS for type of raceway required in different spaces and conditions.
3. PVC80 conduit may be used for exterior underground raceway. Minimum depth-of-bury is 36."
4. Minimum raceway size is 3/4" trade size.

5. Line voltage conductors shall be solid copper conductors with 600 V-rated THWN insulation. Provide #10 gauge minimum, with adjustments for long runs. Preferred initiation loop conductors are West Penn.
6. Signal circuits shall be #14 AWG THWN 19 strand copper.
7. Annunciator Circuits shall be #16 AWG THWN 19 strand copper.
8. Wire AWG sizes shall be adjusted to a larger size as required by the manufacturers' voltage drop recommendations and the load served.
9. Color code all conductors per BCSB standard:

Color Code:		Positive	Negative
Audio/visual	#14 AWG (THWN)	+blue	-yellow
Relay circuit	#14 AWG (THWN)	+purple	-gray (NC)
Door holders	#14 AWG (THWN)	+brown	-orange
Gas shutoff	#14 AWG (THWN)	+blue	-yellow
24 – 28 VDC	#14 AWG (THWN)	+red	-black
Automatic (non addressable)	#14 AWG (THWN)	+yellow	-brown
Manual (non addressable)	#14 AWG (THWN)	+blue	-purple

10. All conductors shall be unspliced between devices. Make connections directly to device terminals.
11. Tee tapping of circuits is prohibited.

C. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches above the finished floor.

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

D. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix Ain NFPA 72.

5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

E. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

F. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

G. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

H. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

I. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

L. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

M. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

3.2 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated air-conditioning duct systems.
4. Alarm-initiating connection to elevator recall system and components.
5. Alarm-initiating connection to activate emergency lighting control.

6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
9. Supervisory connections at elevator shunt trip breaker.
10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
11. Supervisory connections at fire-pump engine control panel.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by Architect and authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.

4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 28 31 11

Division 31

Earthwork

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SECTION 31 31 16
TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes pre-construction soil treatment for underslab and foundation wall perimeters.

1.3 SUBMITTALS

A. Submit the following according to Division 01 requirements.

B. Product Data:

1. Chemicals and products used
2. Application instructions
3. Certification that products used comply with U.S. Environmental Protection Agency (EPA) regulations for termiticides.
4. Information that soil treatment conforms to specified requirements

C. Provide information regarding the type of equipment to be used to apply the soil treatment, size of volume mixing tank, the pump capacity in gallons per minute, and the application tools with in-line flow meter devices attached.

D. Certificate of Compliance: Submit as part of the Close Out Documents the following statement from the pest control company: “The building has received a complete treatment for the prevention of subterranean termites. Treatment is in accordance with rules and laws established by the Florida Department of Agriculture and Consumer Services.”

E. Submit job site log book.

F. Submit warranty.

1.4 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.

B. Engage a professional pest control operator who is licensed according to regulations of the State of Florida.

C. Use only termiticides that bear a federal registration number of the EPA and are approved by local authorities having jurisdiction.

1.5 FIELD CONDITIONS

A. Soil Treatment:

1. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
2. Related Work: Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.6 REGULATORY REQUIREMENTS

A. Minimum requirements for application as authorized by the State of Florida to fulfill the work according to manufacturer's specifications.

1.7 PROJECT RECORD DOCUMENTATION

A. Log Book to be kept at job site ad to include:

1. Project name
2. Company providing treatment
3. Applicator's name
4. Time of arrival and departure
5. Product name
6. Record date of all applications
7. Rate of application to all required areas of the designated site
8. All areas to be treated
9. The soil treatment trade name
10. Quantity of concentrate delivered to the site
11. Quantity used for the designated treated areas
12. The percentage of active ingredient in diluted form
13. Finished gallons of soil treatment for each application
14. Linear and square footage amount to determine total finished soil treatment used

B. Architect will observe both the amount of concentrate delivered to the site and the empty units that total the amount used to the treated areas. The Owner's representative shall sign the logbook as noted.

1.8 DELIVERY

A. The State Registered products must be delivered to the jobsite in the original sealed and labeled containers of the manufacturer. Use a synthetic dye for proper identification on the surface areas treated.

1.9 WARRANTY

A. Warranty: Furnish written warranty, executed by Applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

B. Warranty Period: 5 years from Date of Substantial Completion, or the minimum more than 5 years if prevailing local laws require.

C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.10 PROJECT CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.

B. To ensure penetration, do not apply soil treatment to excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Corporation, Agricultural Products; Termidor SC
b. Bayer Environmental Science; Premise 75 WP.
c. FMC Corporation, Agricultural Products Group; Dragnet FT.
d. Syngenta; Demon Max.

2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare work areas according to the requirements of authorities having jurisdiction and according to manufacturer's written instructions before beginning application and installation of termite control treatment(s). Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, according to requirements of authorities having jurisdiction.

3.3 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.

1. Slabs-on-Grade and Basement Slabs: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and along the entire outside perimeter, from grade to bottom of footing.
3. Masonry: Treat voids.
4. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.

B. Post warning signs in areas of application.

C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

3.4 PROTECTION

A. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

B. Protect termiticide solution dispersed in treated soils and fills from being diluted by exposure to water spillage or weather until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

END OF SECTION 31 31 16

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SECTION 31 31 18
PEST CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide treatment for pest control.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and application instructions in accordance with Division 01 requirements.

B. Submit specific product warranty as specified herein.

1.4 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work, including preparation of substrate application.

B. Engage a professional pest control operator, licensed in accordance with regulations of governing authorities for application of soil treatment solution.

C. Use only chemicals that bear a Federal registration number of the U.S. Environmental Protection Agency.

1.5 SPECIFIC PRODUCT WARRANTY

A. Furnish written warranty, certifying that applied insecticide treatment will prevent infestation of common household insects such as cockroaches, ants, and fleas for a one year period. Re-treat if insect activity is discovered during warranty period.

PART 2 - PRODUCTS

2.1 PEST CONTROL SOLUTION

A. Use an emulsible concentrated insecticide for dilution with water, specially formulated to prevent infestation by insects. Fuel oil will not be permitted as a diluent.

1. Exterior use; “Termidor SC” by BASF – EPA Registered
2. Interior use; “Demand CS” by Syngenta – EPA Registered

B. Other solutions may be used as recommended by Applicator if also acceptable to Architect and approved for intended application by jurisdictional authorities. Use only insecticide treatment solutions that are not injurious to planting.

PART 3 - EXECUTION

3.1 APPLICATION

A. Surface Preparation: Remove foreign matter that could decrease treatment effectiveness on areas to be treated.

B. Application Rates: Mix chemicals (from sealed containers) with water, at the job-site, and then apply concentrate solution only at rates described by the manufacturer on the product label and in compliance with State of Florida laws.

C. Apply to all interior floor-to-wall corners and around building perimeter at existing grades.

D. Apply pest control to all interior spaces of buildings included but not limited to each side of bottom of interior walls, interior side of exterior walls, bottom of vinyl bases, perimeter of windows, bottom of exterior side of exterior wall and any other areas/openings on exterior side of building(s).

1. The Owner shall be contacted at least one (1) week prior to the first application in order to verify planned treatments and to confirm the appropriateness of the products to be used.

E. Post signs in areas of application to warn workers that insecticide treatment has been applied. Remove signs when areas are covered by other construction.

F. Re-apply concentrate solution to areas disturbed by construction activities following application.

G. Applicator shall mix all treatment on-site and the Owner’s representative shall witness mixing.

H. Three treatments will be required.

1. Immediately after building is considered dried-in by the Architect.
2. One week prior to the expected Date of Substantial Completion.
3. After the eleventh month, prior to the expiration of the one-year warranty period. This treatment will be considered an item on the Warranty Corrections and Completions List.

I. Applicator shall treat all interior spaces of buildings including but not limited to each side of bottom of interior walls, interior side of exterior walls, bottom of vinyl bases, Perimeter of windows, bottom of exterior side of exterior wall, and any other areas/ openings on exterior side of building.

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Division 32

Exterior Improvements

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SECTION 32 18 25
BALLFIELD INFIELD SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ballfield infield and warning track surfaces for baseball and softball fields.

1.3 GENERAL REQUIREMENTS

A. Refer to Drawings for area to receive clay mixture.

B. Coordinate work with related work, including sod, in order to expedite installation of work.

C. The installation of all materials shall be performed in accordance with the manufacturer's written installation instructions, and in compliance with all approved drawings. Furnish all materials, equipment, tools, labor, transportation, and services to install, grade, and place field subgrade and infield mix as specified and shown on the drawings, including but not limited to:

1. Placement or preparation of base grade (including raking, leveling, and compaction), in addition to the placement and compaction of the infield mix.
2. Incorporation of infield conditioner, fine grading, dragging, top dressing with vitrified shale or calcined clay product, moisture management, and other maintenance of skinned infield surface until the point of substantial completion.

1.4 SUBMITTALS

A. Product Data: Product description, material test data, sieve analysis, and certifications for each product specified including 3rd party laboratory test prepared by a qualified soil analysis laboratory indicating particle size analysis and sieve analysis of the specified material. All tests shall be performed in accordance with ASTM F-1632. Products include :

1. Infield Mix Material
2. Mounding Clay
3. Soil Conditioner
4. Warning Track Subbase Material

B. Samples:

1. Provide Submit a 1 quart sample for each product specified.

PART 2 - MATERIALS

2.1 INFIELD MIX

A. Provide Infield Mix for the following areas:

1. All infield areas except areas noted to receive a different mix
2. Warning tracks

B. Infield mix shall consist of a 70% sand / 12% silt / 18% clay mix to the depths specified on the drawings.

C. Sieve Analysis (+/-2%)

Sieve No.	Percent Passing by weight
5	99.9
10	99
18	98
35	90
60	47
100	34
270	29

D. Particle Size Analysis (+/- 2%)

Soil Gradation	Percent
Sand (2 mm to .05 mm	70
Silt (.05 mm - .002 mm)	12
Clay (<0.002 mm)	18

2.2 MOUNDING CLAY

A. Provide Mounding Clay for the following areas:

1. Home plate and batter's/catcher's boxes
2. Pitcher's mound
3. On deck circles
4. Base coach boxes

B. Mounding Clay shall have a maximum of 20% sand content as tested through an accredited soils lab, and shall have a minimum of 40% clay content. The ratio of silt to clay in the mix shall be 0.75 – 1.25.

2.3 INFIELD SOIL CONDITIONER

A. Terragreen Super Red Fine by Partac Peat Corporation, Turface by Aimcor, Deerfield, Illinois or approved equal. Soil Conditioner to be blended into the infield mix per manufacturer's recommendations.

2.4 WARNING TRACK SUBBASE

A. ABC gravel material consisting of less than 50% fines, greater than 50% gravel 3/4" diameter or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Substrate: Provide written verification that the field subgrade is acceptable regarding compaction, elevation and free of debris before commencing the work specified in this section.

3.2 INSTALLATION

A. Protect all on-going work, so as to not delay work due to weather or project related construction.

B. Field Layout: Lay out the skinned area of the field as indicated on the drawings and as directed by the Owner's representative. Obtain the approval of the Architect.

C. Do not begin final laser grading of athletic fields until the following has occurred:

1. Topsoil for either the infield or outfield grass has been analyzed by a qualified testing agency to determine what amendments are required.
2. Topsoil amendments deemed necessary have been incorporated.

D. Skinned Areas:

1. Infield Mix Depth:

a. 6" minimum for all areas to receive this mix

2. Mounding Clay Depth:

a. Areas to receive Mounding Clay will have a top layer of Infield Mix as specified below.
b. Pitcher's Mound: from top of mound (varies) to 6" minimum below finished grade of surrounding field. Topdress with ¼" of Infield Mix
c. Batter's/Catcher's Boxes, On Deck Circles, and Base Coach Boxes: 7" minimum overall mix profile depth with the top 1 inch consisting of Infield Mix

3. Install this material over a layer of processed sand.

4. Infield Soil Conditioner: If required due to a successful submittal alternate for infield mix, install conditioner into the alternate infield mix a depth of 1 inch in accordance with the manufacturer's instructions.

3.3 INFIELD MIX PLACEMENT

A. Determine finish grade contours on the 25' grid. Provide a stake every 25'.

B. Material shall be placed in lifts of 1 to 2 inches and compacted to between 85 and 90% of standard proctor (ASTM D 689-07). Rough surface before placing next lift and ensure material is spread and finished utilizing equipment with an appropriate blade length. Utilize external water source to maintain proper moisture of infield mix during installation. Do not install as a powder product, this can create settling and effect the final grade after installation.

C. Compact and drag smooth installation. Infield mix should be free of divots, bumps, or other obstructions that would interfere with ball travel or the movement of water. Surface slope is to be maintained with no ponding evident during rain event.

D. Top Dressing: After final grading is completed, the field shall be top dressed by application of a calcined clay or shale product to assist in managing moisture under the infield skin. Turface SlideMaster, or approved equal. Application rate ishall be per manufacturer's recommendations to achieve an approximate coverage thickness of 1/8" to 1/4" on the infield surface.

3.4 FIELD QUALITY CONTROL

A. Testing Agent: Shall test and approve all materials delivered to the site before placement as well as any subsequent tests during construction necessary to certify performance of the field system.

1. Skinned Areas: These areas should be maintained in smooth, firm and safe conditions. This will include rolling, raking, spiking, dragging, tamping, and keeping moisture in the materials. All materials required to keep the areas in "playable" condition will be the responsibility of the Owner to be installed by the contractor. Area should be tilled once in the fall prior to winterization of complex.
2. Pitching mounds will require a cover to be provided by the Owner. Moisture content in the mound will be the responsibility of the contractor.

3.5 CONTRACTOR'S RECORD OF CERTIFICATION

A. Contractor's records of certification will be required for the following, and three copies each of all documentation shall be furnished the Owner for record purposes:

1. Certificate of Conformance will be required for the following:

   a. Ballfield Clay mixtures
   b. Topsoil

2. Test Reports: The results of laboratory tests performed on the soil material shall be submitted. The reports shall include the pH level, the amount of organic matter, and available phosphoric acid and potash of the soil intended for use in the work.

3.6 GUARANTEE AND REPLACEMENT

A. Infield Clay mixtures shall be guaranteed for a period of thirty days from the time of job acceptance.

B. Replacement of soil necessary during the maintenance period shall be the responsibility of the Contractor, except for possible replacements due to theft, vandalism, neglect by Owner or acts of negligence on the part of others.

C. The time limit may be extended by agreement for any material in questionable condition at the end of the guaranty period.

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SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Chain-link fences.
2. Swing gates.
3. Horizontal-slide, motor-operated gates.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review sequence of operation for each type of gate operator.
3. Review coordination of interlocked equipment specified in this Section and elsewhere.
4. Review required testing, inspecting, and certifying procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Fence and gate posts, rails, and fittings.
b. Chain-link fabric, reinforcements, and attachments.
c. Gates and hardware.
d. Gate operators, including operating instructions and motor characteristics.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.
3. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
4. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: For each type of factory-applied finish.

D. Delegated-Design Submittal: For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer and testing agency.

B. Product Certificates: For each type of chain-link fence, operator, and gate.

C. Product Test Reports: For framework strength according to ASTM F1043, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gate operators to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Emergency Access Requirements: According to requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.

C. Mockups: Build mockups to set quality standards for fabrication and installation.

1. Build mockup for typical chain-link fence and gate, including accessories.

a. Size: 10-foot length of fence.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.9 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to comply with performance requirements.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Faulty operation of gate operators and controls.

2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design chain-link fence and gate frameworks.

B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.

1. Design Wind Load: As indicated on Drawings.

a. Minimum Post Size: Determine according to ASTM F1043 for post spacing not to exceed 10 feet for Material Group IA, ASTM F1043, Schedule 40 steel pipe.
b. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified.

C. Lightning Protection System: Maximum resistance-to-ground value of 5 ohms at each grounding location along fence under normal dry conditions.

2.2 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire for Fabric: Wire diameter of 0.192 inch.

a. Mesh Size: 2 inches.
b. Zinc-Coated Fabric: ASTM A392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied after weaving.

3. Selvage: Twisted top and knuckled bottom.

2.3 FENCE FRAMEWORK

A. Posts and Rails: ASTM F1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F1043 or ASTM F1083 based on the following:

1. Fence Height: As indicated on Drawings.

2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.

a. Line Post: 2.375 inches in diameter.
b. End, Corner, and Pull Posts: 4.0 inches in diameter.

3. Brace Rails: ASTM F1043.
4. Metallic Coating for Steel Framework:

a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A123/A123M or 4.0-oz./sq. ft. zinc coating according to ASTM A653/A653M.

2.4 TENSION WIRE

A. Steel Wire: 0.177-inch- diameter, tension wire according to ASTM F1664, Class 2b over zinc-coated steel wire.

2.5 SWING GATES

A. General: ASTM F900 for gate posts swing gate types.

1. Gate Leaf Width: As indicated.
2. Framework Member Sizes and Strength: Based on gate fabric height as indicated.

B. Pipe and Tubing:

1. Zinc-Coated Steel: ASTM F1043 and ASTM F1083; protective coating and finish to match fence framework.
2. Gate Posts: Round tubular steel.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded.

D. Hardware:

1. Hinges: 360-degree inward and outward swing.
2. Latch: Permitting operation from both sides of gate.

2.6 HORIZONTAL-SLIDE GATES

A. General: ASTM F1184 for gate posts and single sliding gate types. Provide automated vehicular gates according to ASTM F2200.

1. Classification: V-tracked rolling type supported by 8" wheels and side rollers. Far end of gate shall have end-catch.

    a. Gate Frame Width and Height: As indicated.

B. Pipe and Tubing:

1. Zinc-Coated Steel: Protective coating and finish to match fence framework.
2. Gate Posts: ASTM F1184. Provide round tubular steel posts.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded.

D. Hardware:

1. Hangers, Roller Assemblies, and Stops: Fabricated from mill-finished Grade 319 aluminum-alloy casting with stainless-steel fasteners.

2.7 FITTINGS

A. Provide fittings according to ASTM F626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:

    a. Hot-Dip Galvanized Steel: 0.148-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.

2.8 GATE OPERATORS

A. Gate Operators, with internal solenoid kit for gate operator, and contact closure for access control system when gate is in open/ closed position.

B. Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.

1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
2. Provide operator with UL approval.
3. Provide electronic components with built-in troubleshooting diagnostic feature.
4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.

C. Comply with NFPA 70.

D. UL Standard: Manufacturer and label gate operators to comply with UL 325.

E. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1 and the following:

1. Voltage: 120 V NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
2. Horsepower: Not less than 3/4.
3. Enclosure: Totally enclosed.
4. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
5. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
6. Phase: Polyphase.

F. Gate Operators: Concrete base mounted and as follows:

1. Mechanical Swing and Slide Gate Operators:

a. Duty: Heavy duty, commercial/industrial.
b. Gate Speed: Minimum 60 feet per minute.
c. Maximum Gate Weight: 3000 lb.
d. Frequency of Use: Continuous duty.
e. Drive Type: Enclosed worm gear and chain-and-sprocket reducers, roller-chain drive.

2. Long-range vehicle identification reader (Located at Gate): Functions only when authorized card is presented. .

a. Reader with wall or pole mount kit and weather protection hood.
b. Features: Gate monitoring and status provided by access control system.

G. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:

1. Action: Reverse gate in both opening and closing cycles, and hold until clear of obstruction.
2. Action: Stop gate in opening cycle and reverse gate in closing cycle, and hold until clear of obstruction.
3. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
4. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using take-up cable reel gate edge transmitter and operator receiver system.

    a. Where indicated on Drawings.

5. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.

H. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions. Photosensor will require second set of contacts to notify access control system when sensor is obstructed.

I. Operating Features:

1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
3. Automatic Closing Timer: With adjustable time delay before closing and timer cutoff switch.
4. Open Override Circuit: Designed to override closing commands.
5. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
6. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.

J. Accessories:

1. External electric-powered solenoid lock with delay timer allowing time for lock to release before gate operates.
2. Instructional, Safety, and Warning Labels and Signs: Manufacturer's standard for components and features specified.
3. Equipment Bases/Pads: Precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

2.9 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

2.10 GROUNDING MATERIALS

A. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a certified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Concealed Concrete: Place top of concrete 2 inches below grade to allow covering with surface material.
b. Posts Set in Concrete: Form foundations 2 feet deep x 12 inches wide.

D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.

E. Line Posts: Space line posts uniformly at 10 feet o.c.

F. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

G. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

H. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

I. Intermediate and Bottom Rails: Secure to posts with fittings.

J. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.

L. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

M. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 GATE-OPERATOR INSTALLATION

A. Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. Excavation: Hand-excavate holes for posts, pedestals, and equipment bases/pads, in firm, undisturbed soil to dimensions and depths and at locations according to gate-operator component manufacturer's written instructions and as indicated.

C. Vehicle Loop Detector System: Bury wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.

D. Ground electric-powered motors, controls, and other devices according to NFPA 70 and manufacturer's written instructions.

3.6 GROUNDING AND BONDING

A. Fence and Gate Grounding:

1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
2. Install ground rods and connections at maximum intervals of 1500 feet.
3. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
4. Ground fence on each side of gates and other fence openings.

    a. Bond metal gates to gate posts.
    b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a ground rod located a maximum distance of 150 feet on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

E. Connections:

1. Make connections with clean, bare metal at points of contact.
2. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
3. Make above-grade ground connections with mechanical fasteners.
4. Make below-grade ground connections with exothermic welds.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

F. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Prepare test reports.

3.8 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operator: Energize circuits to electrical equipment and devices, start units, and verify proper motor rotation and unit operation.

1. Hydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
2. Test and adjust operators, controls, alarms, and safety devices. Replace damaged and malfunctioning controls and equipment.
3. Lubricate operator and related components.

C. Lubricate hardware and other moving parts.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 32 31 13

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SECTION 32 31 16
WELDED WIRE FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metallic-coated-steel, welded-wire fences.
2. Swing gates.
3. Horizontal-slide gates.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fencing and gates.

1. Include plans, elevations, sections, gate locations, post spacing, and mounting attachment details, and grounding details.

C. Samples: For each fence material and for each color specified.

1. Provide Samples 12 inches in length for linear materials.
2. Provide Samples 12 inches square for wire mesh.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For gate operators to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind Loading:

1. Fence Height: 0 to 15 feet.
2. Wind Exposure Category: As Indicated.
3. Design Wind Speed: Ad Indicated.

B. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 METALLIC-COATED-STEEL, WELDED-WIRE FENCES

A. Metallic-Coated-Steel, Welded-Wire Fences:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Omega II Fence Systems; a division of Metaltech - Omega Inc.; Omega Architectural or a comparable product by one of the following:

a. Ameristar Fence Products; an ASSA ABLOY company.
b. Ametco Manufacturing Corporation.

B. Fence Fabric: Metallic-coated-steel wire.

1. Spacing of Vertical Wires: 2 inches.
2. Vertical Wire Size: 0.192 inch.
3. Spacing of Horizontal Wires: 6inches.
4. Horizontal Wire Size: 0.192 inch.

C. Posts:

1. Line Posts: Square tubes 3 by 3 inches formed from 0.120-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
2. End and Corner Posts: Square tubes 3 by 3 inches formed from 0.120-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
3. Posts at Swing Gate Openings: Square steel tubing 4 by 4 inches with 3/16-inch wall thickness, hot-dip galvanized.
4. Posts at Horizontal-Slide Gate Openings: Square steel tubing 4 by 4 inches with 3/16-inch wall thickness, hot-dip galvanized.
5. Guide Posts for Class 1 Horizontal-Slide Gates: Square tubes 3 by 3 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication; installed adjacent to gate post to permit gate to slide in space between.

6. Guide Posts for Class 1 Horizontal-Slide Gates: Square steel tubing 4 by 4 inches with 3/16-inch wall thickness, hot-dip galvanized; installed adjacent to gate post to permit gate to slide in space between.

D. Post Caps: Formed from steel sheet and hot-dip galvanized after forming.

E. Fasteners: Manufacturer's standard corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers or clips.

F. Finish: Powder coating.

2.3 SWING GATES

A. Gate Configuration: As indicated.

B. Gate Frame Height: As indicated.

C. Gate Opening Width: As indicated.

D. Galvanized-Steel Frames and Bracing: Fabricate members from square tubes 2 by 2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.

E. Frame Corner Construction: Welded.

F. Additional Rails: Provide Mid Height Rail for attachment of panic device, shall be 18-inches tall.

G. Infill: Welded-wire fence fabric matching adjacent fence.

H. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

I. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.

1. Function: 39 - Full surface, triple weight, antifriction bearing.
2. Material: Wrought steel, forged steel, cast steel, or malleable iron; galvanized.

J. Rim Locks: BHMA A156.5, Grade 1, suitable for exterior use.

1. Material: Cast, forged, or extruded brass or bronze.
2. Mounting Plate: Configuration necessary for mounting locks. Fabricate from 1/8-inch-thick, steel plate; hot-dip galvanize after fabrication.

K. Exit Hardware: BHMA A156.3, Grade 1, Type 1 (rim exit device), with push pad actuating bar, suitable for exterior use.

L. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 3/4-inch-diameter, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.

M. Finish: Powder coating.

2.4 HORIZONTAL-SLIDE GATES

A. Gate Configuration: As indicated.

1. Type: Cantilever slide, with internal roller assemblies.

B. Gate Frame Height: As indicated.

C. Gate Opening Width: As indicated.

D. Galvanized-Steel Frames and Bracing: Fabricate members from square tubing.

1. Frame Members: Square tubes 2-1/2 by 2-1/2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
2. Bracing Members: Square tubes 2-1/2 by 2-1/2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.

E. Frame Corner Construction:

1. Welded frame with panels assembled with bolted or riveted corner fittings and 5/16-inch-diameter, adjustable truss rods for panels 5 feet wide or wider.

F. Additional Rails: Provide as indicated, complying with requirements for fence rails.

G. Infill: Comply with requirements for adjacent fence.

H. Track Assembly: Manufacturer's standard track, with overhead framing supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.

I. Hardware: Latches permitting operation from both sides of gate, locking devices hangers roller assemblies and stops fabricated from galvanized steel. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

J. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

K. Finish: Powder coating.

2.5 FENCE AND GATE MATERIALS

A. Metallic-Coated-Steel Wire: Welded-wire fence fabric, hot-dip galvanized after fabrication. Weight of zinc coating shall be not less than 1.0 oz./sq. ft..

B. Plates, Shapes, and Bars: ASTM A36/A36M, with G60 coating..

C. Tubing: ASTM A500/A500M, cold-formed steel tubing, with G60 coating..

D. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, Grade 50, with G60 coating.

E. Galvanizing: For components indicated to be galvanized and for which galvanized coating is unspecified, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 03 30 00 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C 387/C 387M mixed with potable water according to manufacturer's written instructions.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.7 GROUNDING MATERIALS

A. Grounding Conductors: Size as indicated on Drawings. Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1-5/8 inch wide and 1/16 inch thick, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Grounding Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic-welded type.
2. Grounding Rods: Copper-clad steel.

a. Size: 5/8 by 96 inches.

2.8 METALLIC-COATED-STEEL FINISHES

A. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a zinc-phosphate conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A 780/A 780M.

B. Powder Coating: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat finish consisting of zinc-rich epoxy prime coat and TGIC polyester topcoat to a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils.

1. Color and Gloss: Match Architects Sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening infill panels to posts. Peen threads of bolts after assembly to prevent removal.

C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.

D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Concealed Concrete: Top 2 inches below gradeto allow covering with surface material. Slope top surface of concrete to drain water away from post.

3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:

1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.

a. Gates and Other Fence Openings: Ground fence on each side of opening.

1) Bond metal gates to gate posts.
2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

F. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

G. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports of grounding resistance at each test location, certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

3.7 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION 32 31 16

SECTION 32 31 19
DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Decorative aluminum fences.
2. Swing gates.
3. Horizontal-slide gates.
4. Gate operators, including controls.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fencing and gates.

1. Include plans, elevations, sections, gate locations, post spacing, and mounting attachment details, and grounding details.
2. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
3. Wiring Diagrams: Include diagrams for power, signal, and control wiring.

C. Samples: For each fence material and for each color specified.

1. Provide Samples 12 inches in length for linear materials.
2. Provide Samples 12 inches square for bar grating and sheet or plate materials.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Product Test Reports: For decorative fences and gates, including finish, indicating compliance with referenced standard and other specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For gate operators to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Include 10-foot length of fence complying with requirements.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind Loading: As indicated on the Drawings

B. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 DECORATIVE ALUMINUM FENCES

A. Decorative Aluminum Fences: Fences made from aluminum extrusions.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ameristar Fence Products; an ASSA ABLOY company.
b. Iron Eagle Industries, Inc.
c. Merchants Metals.
d. Virginia Railing and Gates, LLC.

B. Posts: Square extruded tubes.

1. Line Posts: 3 by 3 inches with 0.100-inch wall thickness.
2. End and Corner Posts: 3 by 3 inches with 0.125-inch wall thickness.
3. Swing Gate Posts: 4 by 4 inches with 0.250-inch wall thickness.
4. Horizontal-Slide Gate Post, Openings up to 12 Feet: 4 by 4 inches with 0.250-inch wall thickness.
5. Horizontal-Slide Gate Post, Openings Wider Than 12 Feet: 6 by 6 inches with 0.250-inch wall thickness.
6. Guide Posts for Class 1 Horizontal-Slide Gates: 3 by 3 inches with 0.125-inch wall thickness; installed adjacent to gate post to permit gate to slide in space between.

C. Post Caps: Aluminum castings that cover entire top of posts.

D. Pickets: Extruded-aluminum tubes, 1 inch square, with 0.062-inch wall thickness.

1. Extend pickets beyond top rail as indicated and press flat and trim to produce spear point shape.
2. Picket Spacing: 4 inches clear, maximum.

E. Fasteners: Manufacturer's standard concealed fastening system.

F. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers.

G. Fabrication: Assemble fences into sections by welding pickets to rails.

1. Fabricate sections with clips welded to rails for field fastening to posts.
2. Drill clips for fasteners before finishing.

H. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

I. Finish: Baked enamel or powder coating.

2.3 SWING GATES

A. Gate Configuration: As indicated.

B. Gate Frame Height: As indicated.

C. Gate Opening Width: As indicated.

D. Automated vehicular gates shall comply with ASTM F2200, Class III.

E. Aluminum Frames and Bracing: Fabricate members from square extruded-aluminum tubes 2-1/2 by 2-1/2 inches with 0.154-inch wall thickness.

F. Frame Corner Construction: Welded.

G. Additional Rails: Provide as indicated, complying with requirements for fence rails.

H. Infill: Comply with requirements for adjacent fence.

I. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.

1. Treillage: Provide iron castings of pattern indicated between each pair of pickets. Finish as specified for adjacent fence.

J. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

K. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.

1. Function: 39 - Full surface, triple weight, antifriction bearing.

2. Material: Wrought steel, forged steel, cast steel, or malleable iron; galvanized.

L. Rim Locks: Refer to Specification 08 71 00 “Door Hardware.”

M. Electric Strikes: Refer to Specification 08 71 00 “Door Hardware.”

N. Exit Hardware: Refer to Specification 08 71 00 “Door Hardware.”

O. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 3/4-inch- diameter, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.

P. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

Q. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.

R. Aluminum Finish: Baked enamel or powder coating.

2.4 HORIZONTAL-SLIDE GATES

A. Gate Configuration: As indicated.

1. Type: V-tracked rolling type supported by 8” wheels and side rollers. Far end of gate shall have end-catch.

B. Gate Frame Height: As indicated.

C. Gate Opening Width: As indicated.

D. Automated vehicular gates shall comply with ASTM F2200, Class III.

E. Aluminum Frames and Bracing: Fabricate members from square tubing.

1. Frame Members: Extruded-aluminum tubes 2-1/2 by 2-1/2 inches with 0.154-inch wall thickness.
2. Bracing Members: Extruded-aluminum tubes 2-1/2 by 2-1/2 inches with 0.154-inch wall thickness.

F. Frame Corner Construction:

1. Welded frame with panels assembled with bolted or riveted corner fittings and 5/16-inch-diameter, adjustable truss rods for panels 5 feet wide or wider.
2. Overhead Slide Gates: Welded or assembled with corner fittings including 5/16-inch-diameter, adjustable truss rods for panels 5 feet wide or wider.

G. Additional Rails: Provide as indicated, complying with requirements for fence rails.

H. Infill: Comply with requirements for adjacent fence.

I. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.

1. Treillage: Provide iron castings of pattern indicated between each pair of pickets. Finish as specified for adjacent fence.

J. Hardware:

1. Hangers, Roller Assemblies, and Stops: Fabricated from mill-finished Grade 319 aluminum-alloy casting with stainless-steel fasteners.

K. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

L. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.

M. Aluminum Finish: Baked enamel or powder coating.

2.5 GATE OPERATORS

A. Gate Operators:

1. Basis of Design Product and Manufacturer; HySecurity, Model SlideDriver 20022 ex 17 ST. With internal solenoid kit for gate operator, and contact closure for access control system when gate is in open/ closed position.

B. Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.

1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
2. Provide operator with UL approval.
3. Provide electronic components with built-in troubleshooting diagnostic feature.
4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.

C. Comply with NFPA 70.

D. UL Standard: Manufacturer and label gate operators to comply with UL 325.

E. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1 and the following:

1. Voltage: 208-220 V NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
2. Horsepower: Not less than 3/4.
3. Enclosure: Totally enclosed.
4. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
5. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
6. Phase: Polyphase.

F. Gate Operators: Concrete base mounted and as follows:

1. Mechanical Swing and Slide Gate Operators:

a. Duty: Heavy duty, commercial/industrial.
b. Gate Speed: Minimum 60 feet per minute.
c. Maximum Gate Weight: 3000 lb.
d. Frequency of Use: Continuous duty.
e. Drive Type: Enclosed worm gear and chain-and-sprocket reducers, roller-chain drive.

G. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:

1. Action: Reverse gate in both opening and closing cycles, and hold until clear of obstruction.
2. Action: Stop gate in opening cycle and reverse gate in closing cycle, and hold until clear of obstruction.
3. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
4. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using take-up cable reel gate edge transmitter and operator receiver system.

a. Where indicated on Drawings.

5. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.

H. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions. Photosensor will require second set of contacts to notify access control system when sensor is obstructed.

I. Operating Features:

1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
3. Automatic Closing Timer: With adjustable time delay before closing and timer cutoff switch.
4. Open Override Circuit: Designed to override closing commands.
5. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
6. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.

J. Accessories:

1. External electric-powered solenoid lock with delay timer allowing time for lock to release before gate operates.
2. Instructional, Safety, and Warning Labels and Signs: Manufacturer's standard for components and features specified.

3. Equipment Bases/Pads: Precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

2.6 ALUMINUM

A. Aluminum, General: Provide alloys and tempers with not less than the strength and durability properties of alloy and temper designated in paragraphs below for each aluminum form required.

B. Extrusions: ASTM B221, Alloy 6063-T5.

C. Tubing: ASTM B429/B429M, Alloy 6063-T6.

D. Plate and Sheet: ASTM B209, Alloy 6061-T6.

E. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.

F. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.7 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 03 30 00 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M and specifically recommended by manufacturer for exterior applications.

2.8 GROUNDING MATERIALS

A. Comply with requirements of Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Grounding Conductors: Size as indicated on Drawings. Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Aluminum.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1-5/8 inch wide and 1/16 inch thick, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

C. Grounding Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic-welded type.

2. Grounding Rods: Copper-clad steel.

a. Size: 5/8 by 96 inches.

2.9 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Section 01 73 00 "Execution."

3.3 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening rails and infill panels to posts. Peen threads of bolts after assembly to prevent removal.

C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.

D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around posts and sleeves and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
    b. Concealed Concrete: Top 2 inches below gradeto allow covering with surface material. Slope top surface of concrete to drain water away from post.

3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
4. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.

    a. Extend posts at least 5 inches into sleeve.
    b. After posts have been inserted in sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.

5. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch larger than outside diagonal dimension of post.

    a. Extend posts at least 5 inches into concrete.
    b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GATE OPERATOR INSTALLATION

A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. Excavation for Concrete Bases: Hand-excavate holes for bases in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.

C. Concrete Bases: Cast-in-place or precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

D. Vehicle Loop Detector System: bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.

E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.6 GROUNDING AND BONDING

A. Comply with Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:

1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.

a. Gates and Other Fence Openings: Ground fence on each side of opening.

1) Bond metal gates to gate posts.
2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

D. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

E. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

F. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

G. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

H. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports of grounding resistance at each test location certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

3.8 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, and limit switches.

1. Hydraulic Operators: Purge operating system, adjust pressure and fluid levels, and check for leaks.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lubricate hardware, gate operators, and other moving parts.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION 32 31 19

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SECTION 32 84 00
PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes and fittings
2. Pipe joining materials
3. Manual valves
4. Automatic control valves
5. Sprinklers
6. Quick couplers
7. Controller
8. Sensors
9. Boxes for automatic control valves
10. Pumping Stations

1.2 PERFORMANCE REQUIREMENTS

A. Irrigation zone control shall be automatic operation with controller and automatic control valves.

B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.

C. Delegated Design: Design 100 percent coverage irrigation system using performance requirements and design criteria indicated on plan notes.

D. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:

1. Irrigation Main Piping: 200 psi.
2. Circuit (Lateral) Piping: 200 psi.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics**,** and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For irrigation systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional designer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Zoning Chart: Show each irrigation zone and its control valve.

B. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Final Inspection.

C. Punch-List Inspection.

D. Approval by Owner.

E. Completion and acceptance of ‘as-built’ drawings.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

B. H.D.P.E. Pipe

1. Pipe shall be made of DR11 HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2.01.A. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black of not less than 2 percent. The manufacture of the HDPE resin shall certify the cell classification indicated.

C. H.D.P.E. Fittings

1. Electrofusion Fittings - Fittings shall be made of DR11 HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted in

2.01.A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans. For potable water systems, all electrofusion fittings shall have AWWA approval.

2. Butt Fusion Fittings- Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2.01.A. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans or accepted by owner/engineer. All fittings shall meet the requirements of AWWA C901 or C906.

D. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedules 40 and 80.

1. PVC Socket Fittings: ASTM D 2466, Schedules 40 and 80.
2. PVC Threaded Fittings: ASTM D 2464, Schedule 80.
3. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.

E. PVC Pipe, Pressure Rated: ASTM D 2241, PVC 1120 compound, SDR 21.

1. PVC Socket Fittings: ASTM D 2467, Schedule 80.
2. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.

2.2 PIPING JOINING MATERIALS

A. H.D.P.E. fusion: Butt Fusion, Electrofusion and socket fusion by certified installer.

B. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.3 MANUAL VALVES

A. Bronze Gate Valves:

1. Basis-of-design Product: Subject to compliance with requirements, provide Nibco T-113 isolation valves, size per plans.

B. Ductile Iron / Cast Iron Gate Valves:

1. Basis-of-design Product: Subject to compliance with requirements, provide Aquafuse Control Flo, with fusible ends, size per plans.

C. Plastic Ball Valves:

1. Basis-of-design Product: Subject to compliance with requirements, provide Matco-Norca schedule 80 ball valve, size per plans.

D. Operating Wrenches for Iron Gate Valve Casings: Furnish two steel, tee-handle operating wrench with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut for project.

2.4 AUTOMATIC CONTROL VALVES

A. Brass, Automatic Control Valves:

1. Basis-of-design Product: Subject to compliance with requirements, provide Rain Bird 300 BPES, with Baseline BL-5201 MV decoder, per plans.

B. Plastic, Automatic Control Valves:

1. Basis-of-design Product: Subject to compliance with requirements, provide Rain Bird PESB series with an isolation valve upstream, per plans.
2. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment and operated by a 24 volt A.C. solenoid.

2.5 SPRINKLERS

A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.

B. Plastic, Pop-up Sprinklers:

1. Basis-of-design Product: Subject to compliance with requirements, provide Rain Bird 1804-SAM with PA-80 adapter, 1806-SAM-PRS, 1812-SAM-PRS, with nozzle per plans and on risers where indicated per plans.

C. Polyethylene, Drip Irrigation:
1. Basis-of-design Product: Subject to compliance with requirements, provide Netafim pressure compensating landscape dripline model TLHCVXR7-CS-12XX with copper stripe, check valve and anti-siphon feature shall be of nominal sized one-half inch low density, ultraviolet resistant, linear polyethylene tubing with internal pressure-compensating, self-cleaning, integral drippers (each with a built in check valve) at a specified interval. The tubing shall be brown in color and shall conform to an outside diameter (O.D.) of .66" and an inside diameter (I.D.) of .56". The low volume tubing shall be capable of discharging 0.77 gallons per hour (G.P.H.) between operating pressures of 15 to 50 PSI for each dripper.

D. Plastic, Pop-up Rotors:

1. Basis-of-design Product: Subject to compliance with requirements, provide Hunter I-20, or PGP Ultra rotors, 6” pop-up height, with check valve and pressure compensating bodies, with nozzle per plans.

2.6 QUICK COUPLERS

A. Description: Rain Bird 44-RC or 44-LRC, factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key, per plans.

1. Locking-Top Option: Vandal-resistant locking feature. Include two matching keys.

2.7 CONTROLLER

A. Automatic Irrigation Controller (Timer, Clock, etc.):

1. Basis-of-design Product: Subject to compliance with requirements, provide Baseline Basestation 3200-P 2-wire controller, with cell modem #BL-CM4G-T-4Z, per plans.

2.8 SENSORS

A. Flow Sensor:

1. Basis-of-design Product: Subject to compliance with requirements, provide Baseline BL-PFS-200 sensor with integrated decoder, per plans.

B. Rain/Freeze Sensor:

1. Basis-of-design Product: Subject to compliance with requirements, provide Hunter pole-mounted rain/freeze CLIK sensor, per plans.

C. Soil Moisture Sensor:

1. Basis- of-design Product: Subject to compliance with requirements, provide Baseline BL-5315B biSensor, per plans.

2.9 BOXES FOR AUTOMATIC CONTROL VALVES

A. Plastic Boxes:

1. Basis-of-design Product: Subject to compliance with requirements, provide (Old Castle) Carson 1220, 1419, 1017 valve boxes with bolt-down lid, with open bottom and openings for piping; designed for installing flush with grade (per plan details).

a. Size: Per plans (as required for valves and service).
b. Shape: Per plans (as required for valves and service).
c. Sidewall Material: Per plans (as required for valves and service).
d. Cover Material: Locking, per plans (as required for valves and service).
1) Lettering: Using an electric branding iron, brand the valve I.D. letter/number on the lid of each valve box. This brand must be 2"-3" tall and easily legible.

B. Drainage Backfill: Cleaned or washed 3/4 inch gravel, 3.0 inch minimum depth.

2.10 PUMPING STATIONS

A. Irrigation Pump Station:

1. Basis-of-design Product: Provide MCI Flowtronics submersible pumping station, VFD, 460Volt/3Phase power, with enclosure, in new well. (Pump size/well size, pump HP and pump performance T.B.D., per plans).

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

B. Install detectable warning tape directly above pressure piping; type, placement and depth per plans if required.

C. Provide minimum cover over top of underground piping according to the following:

1. Irrigation Main Piping: Minimum depth of 30 inches below finished grade, or 36 inches for vehicular crossings.
2. Circuit (Lateral) Piping: Minimum depth of 18 inches below finished grade, or 24 inches for vehicular crossings.
3. Sleeves: Minimum depth dependent upon sleeve pipe type/size, per plans.

3.2 PIPING INSTALLATION

A. H.D.P.E. Direct Burial

1. Buried HDPE pipe and fittings shall be installed in accordance with ASTM D 2321 or ASTM D 2774 for pressure systems and AWWA Manual of Water Supply Practices M55 Chapter 8. The Design Window identified in AWWA M55 Chapter 5 (page 65 of 2006 version) shall be considered acceptable design and installation conditions.
2. For Horizontal Directional Drilling (HDD), refer to ASTM F1962, PPI TR-46, PPI PE Handbook (Chapter 12) and www.PPIBoreAid.com.

B. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.

C. Install piping free of sags and bends.

D. Install groups of pipes parallel to each other, spaced to permit valve servicing.

E. Install fittings for changes in direction and branch connections.

F. Install unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.

G. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.

H. Install expansion loops in control-valve boxes for plastic piping.

I. Lay piping on solid subbase, uniformly sloped without humps or depressions.

J. Install PVC piping in dry weather when temperature is above 40° F (5° C). Allow joints to cure at least 24 hours at temperatures above 40° F (5° C) before testing.

K. All mains shall be cleaned and flushed to remove all dirt, sand, debris and foreign matter.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. H.D.P.E. Fusion Joining Requirements

1. All HDPE pipe shall be joined to itself by the heat fusion process which produces homogeneous, seal, leak tight joints. Tie-ins between sections of HDPE pipe shall be made by butt fusion whenever possible.
2. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. A record or certificate of training for the fusion operator must be provided that documents training to the fundamentals of ASTM F 2620. Considerations should be given to and provisions made for adverse weather conditions, such as temperatures below freezing, precipitation, or wind, which is accepted by the owner/engineer.
3. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F 1290, PPI TN 34, and PPI Municipal Advisory Board (MAB) Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe. The electrofusion processor must be capable of reading and storing the input parameters and the fusion results for later download to a record file. Qualification of the fusion technician shall be demonstrated by evidence electrofusion training within the past year on the equipment to be utilized for this project.
4. All HDPE fusion equipment operators shall be qualified to the procedure used to perform pipe joining. Fusion equipment operators shall have current, formal training on all fusion equipment employed on the project. Training received more than two years prior to operation with no evidence of activity within the past 6 months shall not be considered current.

E. PE Piping Fastener Joints: Join with insert fittings and bands or fasteners according to piping manufacturer's written instructions.

F. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
3. PVC Non-pressure Piping: Join according to ASTM D 2855.

3.4 VALVE INSTALLATION

A. Underground Valves: Install valves per plan details.

3.5 SPRINKLER INSTALLATION

A. Install sprinklers after hydrostatic test is completed.

B. Install sprinklers at manufacturer's recommended heights.

C. Locate part-circle sprinklers to maintain a minimum distance of 12 inches from foundations and roadways, and 4 inches from sidewalk or roadway edge with curbing and 12-36 inches from roadway edge without curbing (based on equipment, per plan legend, details and notes) unless otherwise indicated, per plans.

3.6 AUTOMATIC IRRIGATION-CONTROL SYSTEM INSTALLATION

A. Install control cable in same trench as irrigation piping and at least 2 inches below piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve (2” minimum size, per plans) under hardscape/paved areas.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Valve Boxes: Using an electric branding iron, brand the valve I.D. letter/number on the lid of each valve box. This brand must be 2 inches to 3 inches tall and easily legible. Distinguish between multiple units.

C. Warning Tapes (if required, per plans): Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches. See Section 312000 "Earth Moving" for warning tapes.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Pressure testing mainline shall be conducted in accordance with requirements and recommendations of ASTM F 2164 (Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure), AWWA M55 Chapter 9, and PPI Handbook of Polyethylene Pipe Chapter 2 (2nd Edition). Pneumatic (compressed air) leakage testing of HDPE pressure piping is prohibited for safety reasons.

2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Any irrigation product will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 ADJUSTING

A. Adjust settings of controller(s), per plans.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted aboveground on risers, so they will be flush with finish grade.

3.10 PIPING SCHEDULE

A. Install components having pressure rating equal to or greater than system operating pressure.

B. Piping in control-valve boxes may be joined with unions instead of joints indicated, per plans.

C. Underground irrigation main piping shall be one of the following:

1. DR11 4710 IPS H.D.P.E. with fusion-weld fittings, size per plans.
2. Class 200 Gasketed (bell-end) PVC, with Leemco ductile iron fittings and mechanical joint restraints, size per plans.
3. Schedule 40, PVC pipe and socket fittings, and solvent-cemented joints, size per plans.

D. Underground circuit (lateral) piping shall be the following:

1. Class 200 PVC with solvent-cement PVC fittings, size per plans.

2. PE Polyethylene tubing and barbed fittings, size per plans.

E. Underground Offsets at Sprinklers and Devices: Rain Bird SP model 100 swing pipe assembly, per plan details.

1. Option: Plastic swing-joint assemblies, with offsets for flexible joints, manufactured for this application.

F. Risers to Aboveground Sprinklers and Specialties: Schedules 40 and 80 PVC pipe and socket fittings, solvent-cemented joints, stainless steel hose clamp attachments, per plans/plan detail.

G. Risers to Aboveground Sprinklers and Specialties: Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.

END OF SECTION 32 84 00

SECTION 32 90 00
LANDSCAPING

PART 1 – GENERAL

1.1 GENERAL CONDITIONS

A. The landscape contract includes the supplying and planting of all trees, shrubs, vines, and ground cover together with all necessary labor, equipment, tools and materials needed for the successful completion, execution and maintenance of the landscape plans.

1.2 AGENCY STANDARDS

A. Grades and standards of plant materials to be used shall be true to name, size, condition and graded Florida #1 or better as stated in: Grades and Standards of Florida Plant Materials published by the State of Florida Department of Agriculture, Tallahassee, Florida.

1.3 SITE EXAMINATION

A. The Landscape Contractor shall personally examine the site and fully acquaint him/herself with all of the existing conditions in order that no misunderstanding may afterwards arise as to the character or extent of the work to be performed, and additionally, in order to acquaint him/herself with all precautions to be taken in order to avoid injury to property or persons. No additional compensation will be granted because of any unusual difficulties which may be encountered in the execution or maintenance of any portion of the work.

1.4 ERRORS AND OMISSIONS

A. The plant list is a part of the drawings and is furnished as a convenience. The plant list indicates the name, size and quantities of specific plant materials as called for and is located on the drawings. The Landscape Contractor is responsible for his/her own quantity count, and any discrepancy between drawings and plant list shall be considered as correct on the drawings.

B. The Landscape Contractor shall not take advantage of errors or omissions in the specifications or contract drawings. Full instruction will be given if such errors are discovered. Upon the discovery of any discrepancies in, or omissions from the drawings or documents, or should the Landscape Contractor be in doubt as to their meaning, the Landscape Architect shall be notified and will determine the actions necessary to each query.

C. If plans and specifications are found to disagree after the contract is awarded, the Landscape Architect shall be the judge as to which was intended.

1.5 EXECUTION OF THE WORK

A. The Landscape Contractor shall have his labor crews controlled and directed by a Foreman well versed in plant materials, planting methods, reading blueprints, and coordination between job and nursery in order to execute installation correctly and in a timely manner.

B. The Landscape Contractor shall provide a competent English-speaking Foreman on the project at all times, who shall be fully authorized as the Contractor's agent on the work. The Superintendent shall be capable of reading and thoroughly understanding the Plans, Specifications and other Contract Documents. If the Superintendent is deemed incompetent by the Landscape Architect, he (the superintendent) shall be immediately replaced.

C. The Landscape Contractor shall be available for any meetings with the Owner and/or Landscape Architect during implementation of the job. Any additional work or changes required as a result of failure to communicate with the Owner or Landscape Architect during implementation will be the responsibility of the Landscape Contractor.

1.6 PROTECTION OF PUBLIC AND PROPERTY

A. The Landscape Contractor shall protect all materials and work against injury from any cause and shall provide and maintain all necessary safeguards for the protection of the public. He shall be held responsible for any damage or injury to persons or property which may occur as a result of his fault or negligence in the execution of the work, i.e. damage to underground pipes or cables.

1.7 CHANGES AND EXTRAS

A. The Contractor shall not start work on any changes or "extras" in the project until a written agreement setting forth the adjusted prices has been executed by the Owner and the Contractor. Any work performed on changes or "extras" prior to execution of a written agreement may or may not be compensated for by the Owner at his discretion.

1.8 GUARANTEE

A. The Landscape Contractor shall furnish a written guarantee warranting all materials, workmanship and plant materials, except sod, for a period of ONE (1) YEAR from the time of completion and acceptance by the Landscape Architect and Owner. Sod shall be guaranteed to 90 calendar days after acceptance by the Landscape Architect and Owner. All plant material shall be alive and in satisfactory condition and growth for each specific kind of plant at the end of the guarantee period. The guaranteeing of plant material shall be construed to mean complete and immediate replacement with plant material of the same variety, type, size, quality and grade as that of the originally specified material. During the guarantee period it shall be the Landscape Contractor’s responsibility to immediately replace any dead or unhealthy material as determined by the Landscape Architect. The guarantee will be null and void if plant material is damaged by lightning, hurricane force winds, or any other acts of God, as well as vandalism or lack of proper maintenance.

B. At the end of the specified guarantee period, any plant required under this contract that is dead or not in satisfactory condition, as determined by the Landscape Architect, shall be replaced. The Landscape Contractor shall be responsible for the full replacement cost of plant materials for the first replacement and share subsequent replacement (s) costs equally with the Owner, should the replacement plant fail to survive.

1.9 CARE AND MAINTENANCE

A. The Landscape Contractor shall be responsible for the care and maintenance of all plant materials and irrigation when applicable until final acceptance by the Owner or Landscape Architect.

B. The Owner agrees to execute the instructions for such care and maintenance.

1.10 SAFETY

A. It shall be the responsibility of the Landscape Contractor to protect all persons from injury and to avoid property damage. Adequate warning devices shall be placed and maintained during the progress of the work.

B. It shall be the contractor's responsibility to conform to all local, state, and federal safety laws and codes including the Federal Occupational Safety And Health Act (O.S.H.A.).

1.11 CONTRACTOR QUALIFICATION

A. The Owner may require the apparent contractor (s) to qualify him/herself to be a responsible entity by furnishing any or all of the following documentary data:

1. A financial statement showing assets and liabilities of the company current to date.
2. A listing of not less than (3) completed projects of similar scope and nature.
3. Permanent name and address of place of business.
4. The number of regular employees of the organization and length of time the organization has been in business under the present name.

1.12 INSURANCE AND BONDING:

A. The contractor (s) shall submit proof of insurance for this job for the time period that the work is done. The minimum amount of insurance shall be $300,000.00 per person and $300,000.00 per aggregate or as required by owner and agreed to in the contract. The successful bidder shall be required to have this coverage in effect before beginning work on the site.

B. The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

1.13 PERMITS AND CERTIFICATES:

A. All contractors shall secure and pay for all permits and certificates required for his/her class of work.

PART 2 - MATERIALS

2.1 PLANT MATERIALS:

A. A complete list of plants is shown on the drawings, including a schedule of quantities, sizes, and such other requirements deemed necessary. In the event discrepancies occur, the specifications on the drawings shall govern.

B. Substitutions: Substitutions of plant materials or changes in size or spacing of materials will be permitted ONLY upon written authorization by the Owner or the Landscape Architect. If plant material is not of sufficient size to meet applicable codes, a letter of variance from the appropriate agency must be obtained by the Contractor prior to issuance of any change order. If material of smaller size is to be accepted, the quantity of material shall be increased, at no additional cost to the Owner, to meet the intent of the drawings.

C. All plant materials shall have a habit of growth that is normal for the species and shall be healthy, vigorous and equal to or exceed the measurements specified in the plant list, which are the minimum acceptable sizes. Plants shall be measured before pruning with branches in normal position. Any necessary pruning shall be done at the time of planting.

D. All plant materials shall be nursery grown, unless otherwise noted, Florida #1 or better and shall comply with all required inspections, grading standards and plant regulations as set forth by the Florida Department of Agriculture's Grades and Standards for Nursery Plants, most current addition and Grades and Standards for Nursery Plants, most current addition.

E. Plants that do not have the normal balance of height and spread typical for the respective plant shall not be acceptable.

F. The Landscape Contractor shall install each plant to display its best side. Adjustments may be required if plants are not installed properly and/or approved by the Landscape Architect at no additional cost to owner.

2.2 INSPECTION

A. The Landscape Architect and Owner may inspect trees and shrubs at place of growth or at site before planting, for compliance with requirements for genus, species, variety, size and quality. The Landscape Architect and Owner retain the right to further inspect trees and shrubs for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Rejected plant materials shall be immediately removed from project site.

2.3 PROTECTION OF PLANT MATERIALS

A. Balled and burlapped plants (B & B) shall be dug with firm natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Balls shall be firmly wrapped with burlap similar materials and bound with cord, rope, or wire mesh. All collected plants shall be balled and burlapped.

B. Plants with broken, damaged or insufficient rootballs will be rejected.

C. All plant material shall be protected from possible bark injury or breakage of branches. All plants transported by open trucks shall be adequately covered to prevent windburn, drying or damage to plants.

D. Plants which cannot be planted immediately on delivery to the site shall be covered with moist soil, mulch or other protection from the drying of wind and sun. All plants shall be watered as necessary by the Landscape Contractor until planted.

2.4 STORAGE

A. All plant materials shall be stored on the site in designated areas, specified by the Landscape Architect or Owner's agent.

B. No plant material shall be stored longer than seventy-two (72) hours unless approved by by Landscape Architect and/or owner.

C. The Landscape Architect reserves the right to reject any plant materials not in conformance with these specifications.

D. All rejected material shall be immediately removed from the site and replaced with acceptable material at no cost to the Owner.

2.5 PROTECTION DURING PLANTING

A. Trees moved by winch or crane shall be thoroughly protected from chain marks, girdling or bark slippage by means of burlap, wood battens or other approved methods. Battens shall NOT be attached to the tree with nails.

2.6 PLANTING SOIL

A. Planting soil for all plantings shall consist of existing native soil and shall be free of debris, roots, clay, stones, plants or other foreign materials which might be a hindrance to planting operations or be detrimental to good growth.

2.7 FERTILIZER

A. Commercial fertilizer shall comply with the state fertilizer laws. Nitrogen shall not be less than 40% from organic source. Inorganic chemical nitrogen shall not be derived from the sodium form of nitrate. Fertilizers shall be delivered to the site in unopened original containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer that becomes caked or otherwise damaged shall be rejected.

B. Thoroughly mixed 3 lbs. of commercial fertilizer to each cubic yard of planting soil.

C. Tabletized fertilizer shall be Agriform planting tablets 20-10-5 formula, 21 gram or equal. All trees and shrubs shall be fertilized with tabletized fertilizer as follows. While backfilling plant holes, fertilizer tablets shall be equally spaced and placed adjacent to the ball mid-way in depth in accordance with the following rates:

1 gallon container	1 tablet
3 gallon container	2 tablets
5 gallon container	3 tablets
7 gallon	5 tablets

D. Large tubs, wire baskets, grow bags, and balled and burlapped material shall have 1 tablet for each 1/2 inch of trunk diameter (measured 3 feet from ground) or for each foot of height or spread of larger shrub material. The Landscape Architect reserves the right to inspect and review the application of fertilizer.

2.8 MULCH

A. Mulch material shall be clean, dry, free of weeds, seeds and pests, moistened at the time of application to prevent wind displacement. Cypress &/or Red mulch is prohibited.

B. All trees and shrub beds shall receive 3" mulch immediately after planting and Apply 2" max on tree & palm rootballs, keep away from tree & palm trunks thoroughly watered. or as required by local jurisdiction.

PART 3 - EXECUTION

3.1 DIGGING

A. The Landscape Contractor shall exercise care in digging and other work so as not to damage existing work, including overhead wires, underground pipes and cables and the pipes and hydrants of watering systems. Should such overhead or underground obstructions be encountered which interfere with planting, the Owner shall be consulted and contractor will adjust the location of plants to clear such obstruction. The Contractor shall be responsible for the immediate repair of any damage caused by his work.

3.2 GRADING

A. Grading for drainage, swales, etc. to within 4 inches of the finished grade to be provided by others.

B. It shall be the responsibility of the Landscape Contractor to provide the final grading during the course of landscape installation so as to bring sod and planting areas to their proper elevations in relation to walks, paving, drain structures, and other site conditions. The site grading plan must be checked prior to installation of sod to insure that drainage and other conditions will NOT be modified.

3.3 PLANTING

A. Planting shall take place during favorable weather conditions.

B. The Contractor shall call for utility locates and ascertain the location of all utilities and easements so proper precautions can be taken not to damage or encroach on them.

C. Tree Planting shall be located where it is shown on the plan. No planting holes shall be dug until the proposed locations have been staked on the ground by the Contractor.

E. Excavation of holes shall extend to the required subgrades as specified on the planting diagrams located in the planting plans. Plant pits shall be circular in outline and shall have a profile which conforms to the aforementioned "Tree and Shrub Planting Diagrams".

F. A representative number of planting pits (a minimum of one in every 25 feet throughout the entire site) shall be tested for proper drainage. See Landscape Plan for complete testing methods and requirements.

G. Planting pits shall be excavated to the following dimensions and refilled with a mixture of (1/2) planting soil (1/2) existing native soil;

1 Gallon material (1 gal.): 12" x 12" x 12" min.
3 Gallon material (3 gal.): 20" x 20" x 18" min.
Lerio material (7 gal.): 30" x 30" x 24" min.
Field grown material and trees: 1-1/2 times width of ball and depth of ball plus 12" min.

H. No planting or laying of sod shall be initiated until the area has been cleaned of existing sod or other plant materials, rough grass, weeds, debris, stones etc. and the ground has been brought to an even grade, with positive drainage away from buildings and towards drain inlets and swales and approved by Landscape Architect or owner's rep.

I. Each plant shall be planted in an individual hole as specified for trees, shrubs, and vines.

J. All plants shall be set to ultimate finished grade. No filling will be permitted around trunks or stems. All ropes, wire, stakes, etc., shall be removed from sides and top of the ball and removed from hole before filling in.

K. All flagging ribbon shall be removed from trees and shrubs before planting.

L. Excess excavation (fill) from all holes shall be removed from the site, at no additional expense to Owner.

M. All palms shall be backfilled with sand, thoroughly washed in during planting operations and with a shallow saucer depression left at the soil line for future waterings. Saucer areas shall be top-dressed two (2") inches deep with topsoil raked and left in a neat, clean manner.

3.4 PRUNING

A. Remove dead and broken branches from all plant material. Prune to retain typical growth habit of individual plants with as much height and spread as possible in a manner which will preserve the plant's natural character.

B. Make all cuts with sharp instruments flush with trunk or adjacent branch, in such a manner as to insure elimination of stubs. Cuts made at right angles to line of growth will not be permitted.

C. Trees shall not be poled or topped.

D. Remove all trimmings from site.

3.5 GUYING

A. All trees over six (6') feet in height shall, immediately after setting to proper grade, be guyed with three sets of two strands, No. 12 gauge malleable galvanized iron, in tripod fashion. See Detail.

B. Wires shall not come in direct contact with the tree but shall be covered with an approved protection device at all contact points. Wires shall be fastened in such a manner as to avoid pulling crotches apart.

C. Stake & Brace all trees larger than 12' oa. See detail. Stakes shall be 2" x 2" lumber of sufficient length to satisfactorily support each tree.

D. Turnbuckles for guying trees shall be galvanized or cadmium plated and shall be of adequate size and strength to properly maintain tight guy wires.

3.6 WATER

A. Each plant or tree shall be thoroughly watered in after planting. Watering of all newly installed plant materials shall be the responsibility of the Landscape Contractor until final acceptance by the Landscape Architect.

B. See General Notes of Landscape Plan for water source.

3.7 SOD

A. The Landscape Contractor shall sod all areas indicated on the drawings.

B. It shall be the responsibility of the Landscape Contractor to fine grade all landscape areas, eliminating all bumps, depressions, sticks, stones, and other debris.

C. The sod shall be firm, tough texture, having a compacted growth of grass with good root development. It shall contain no noxious weeds, or any other objectionable vegetation, fungus, insects, or disease. The soil embedded in the sod shall be good clean earth, free from stones and debris.

D. Before being cut and lifted, the sod shall have been mowed at least three times with a lawn mower, with the final mowing not more than seven days before the sod is cut. The sod shall be carefully cut into uniform dimensions.

E. 6-6-6 fertilizer with all trace elements is to be applied at the rate of 40 lbs. per 1,000 sq. ft. prior to laying sod.

F. Solid sod shall be laid with closely abutting, staggered joints with a tamped or rolled, even surface.

G. The finished level of all sod areas after settlement shall be one (1") inch below the top of abutting curbs, walks, paving and wood borders to allow for building turf.

H. If in the opinion of the Landscape Architect, top dressing is necessary after rolling, clean yellow sand will be evenly applied over the entire surface and thoroughly washed in.

3.8 SEEDING

A. The Landscape Contractor shall remove all vegetation and rocks larger than (1") in diameter from areas to be seeded, scarify the area, then apply fertilizer at a rate of 500 lbs. per acre.

B. Application: Argentine Bahia Grass seed - 200 Pounds per acre mixed with common hulled Bermuda seed - 30 lbs. per acre. All other seed mixtures shall be applied per the manufacturer's instructions.

C. Roll immediately after seeding with a minimum 500 pound roller, then apply straw mulch at the rate of 2,500 pounds per acre.

D. Apply fertilizer at the rate of 150 lbs. per acre 45-60 days after seeding.

3.9 CLEANING UP

A. The contractor shall at all times keep the premises free from accumulations of waste materials or rubbish caused by his employees or work. He shall leave all paved areas "broom clean" when completed with his work.

3.10 MAINTENANCE

A. Maintenance shall begin immediately after each plant is installed and shall continue until all planting has been accepted by the Owner or Landscape Architect. Maintenance shall include watering, weeding, removal of dead materials, resetting plants to proper grades or upright positions, spraying, restoration of planting saucer and/or any other necessary operations.

B. Proper protection to lawn areas shall be provided and any damage resulting from planting operations shall be repaired promptly.

C. Replacement of plants during the maintenance period shall be the responsibility of the Contractor, excluding vandalism or damage on the part of others, lighting, or hurricane force winds, until final acceptance.

D. In the event that weeds or other undesirable vegetation become prevalent, it shall be the Contractor's responsibility to remove them.

E. Trees or other plant material which fall or are blown over during the maintenance period will be reset by the Contractor at no additional expense to the Owner, the only exception being hurricane force winds.

3.11 COMPLETION, INSPECTION AND ACCEPTANCE

A. Completion of the work shall mean the full and exact compliance and conformity with the provisions expressed or implied in the Drawings and in the Specifications, including the complete removal of all trash, debris, soil or other waste created by the Landscape Contractor.

B. Inspection of work to determine completion of contract, exclusive of the possible replacement of plants, will be made by the Owner and/or Landscape Architect at the conclusion of all planting and at the request of the Landscape Contractor.

C. All plant material shall be alive and in good growing condition for each specified kind of plant at the time of acceptance. The rating of each plant according to Florida Grades and Standards shall be equal to or better than that called for on the plans and in these Specifications at the time of final inspection and acceptance.

D. After inspection, the Landscape Contractor will be notified by the Owner of the acceptance of all plant material and workmanship, exclusive of the possible replacement of plants subject to guarantee.