THE WATERFORD

A LIFESPACE COMMUNITY®

The Waterford
Campus Redevelopment – Stage 2
Juno Beach, Florida

PROJECT MANUAL

Project No. 2021009

THW DESIGN

Issued for Design Development

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August 22, 2025

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SECTION 011000 - 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. Access to site.
4. Work restrictions.
5. Specification and drawing conventions.
6. Miscellaneous provisions.

1.3 PROJECT INFORMATION

A. Project Identification: The Waterford – Stage 2 – MC/AL.

1. Project Location: Juno Beach, Florida.

B. Owner: Lifespace Communities.

C. Owner’s Representative: Russell Mauk.

D. Owner's Consultants: The Owner has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Program Management: Greenbrier Development.
2. Geotechnical Engineer: Tierra South Florida, Inc.
3. Civil/Structural Engineer: WGI.
4. Interior Design: IDA.
5. Land Planning: WGI.

E. Architect: Thompson, Hancock, Witte & Associates, Inc. (THW Design), 2100 Riveredge Parkway, Suite 900, Atlanta, GA 30328.

F. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Mech./Elect./Plumb./Fire Protection/Low Voltage: Salas O’Brien.
2. Structural: Jazerinac Group.
3. Food Service Equipment: SCOPOS Hospitality Group.
4. Hardware: Dormakaba USA Inc.

G. Contractor: Weitz Construction.

1.4 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.

1.5 PHASED CONSTRUCTION

A. The Work shall be conducted in a single phase designated as Phase 2.

B. Before commencing Work, submit an updated copy of Contractor's construction schedule showing the sequence, commencement and completion dates, and move-out and -in dates of Owner's personnel.

1.6 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with 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 separate contracts.

1.7 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways loading areas, 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 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.

1.8 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1.9 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
2. Obtain Owner’s written permission before proceeding with disruptive operations.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:30 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: Subject to Owner’s prior approval.
2. Early Morning Hours: Subject to Owner’s prior approval.
3. Hours for Utility Shutdowns: Subject to Owner’s prior approval.

C. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

D. Controlled Substances: Use of controlled substances on Project site is not permitted.

1.10 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. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

C. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

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 governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost allowances.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. Purchase products and systems selected by Architect from the designated supplier.

1.4 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 LUMP-SUM AND UNIT-COST ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Civil and Landscape Architectural services have been initiated on this project under a previous agreement.

B. Allowance No. 2: Provide an allowance for the emergency generator based on information provided by the electrical engineer.

C. Allowance No. 3: Establish and provide an appropriate allowance for the kitchen equipment and food-grade millwork based on documentation provided by the Food Service Consultant.

D. Allowance No. 4: Establish and provide an appropriate allowance for the laundry equipment (small laundry for convenience for housekeeping, kitchen, etc. in MCAL building. Assume 2 large-capacity residential washers and 2 dryers) based on consultation with the Owner's consultant.

E. Allowance No. 5: Establish and provide an appropriate allowance for interior and exterior signage based on consultation with the Owner's consultant.

F. Allowance No. 6: Establish and provide a lump sum allowance for the hardware as described in Section 087100 – Door Hardware.

G. Allowance No. 7: Establish and provide an appropriate allowance for the low voltage system based on consultation with the Owner's representative and the Construction Manager.

H. Allowance No. 8: Establish and provide a contingency allowance based on %5of total construction plus escalation.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

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 unit prices.

B. Related Requirements:

1. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.
2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
3. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.3 DEFINITIONS

A. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: Removal of unsatisfactory soil and replacement with satisfactory soil material.

1. Description: Unsatisfactory soil excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, according to Section 312000 "Earth Moving."
2. Unit of Measurement: Cubic yard of soil excavated, based on in-place surveys of volume before and after removal.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

B. Unit Price No. 2: Rock excavation and replacement with satisfactory soil material.

1. Description: Classified rock excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, according to Section 312000 "Earth Moving."
2. Unit of Measurement: Cubic yard of rock excavated, based on survey of in-place surveys volume of before and after removal.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

C. Unit Price No. 3: Cutting and patching of concrete slabs-on-grade.

1. Description: Cutting of new or existing concrete slabs-on-grade up to 6 inches thick, removal and excavation as required, and subsequent backfill, compaction, and patching of concrete according to Section 017300 "Execution." not otherwise indicated in the Contract Documents.
2. Unit of Measurement: Square feet of concrete removed.

D. Unit Price No. 4: Miscellaneous and structural steel.

1. Description: Miscellaneous lintels and other supports not otherwise indicated in the Contract Documents, according to Section 051200 "Structural Steel Framing" and Section 055000 "Metal Fabrications."
2. Unit of Measurement: Cost in place of pounds of fabricated steel as indicated on itemized invoice of steel supplier.

E. Unit Price No. 5: Elevator jack hole rock.

1. Description: Subsurface soil conditions that refuse conventional auger excavation of the elevator jack hole, according to Section 142400 "Hydraulic Elevators."
2. Unit of Measurement: Depth in feet of drilling required as indicated on the elevator Installer's invoice.
3. Assigned Unit Cost: Owner will pay $250.00 per unit foot of rock drilling required.

F. Unit Price No. 6:

1. Description:
2. Unit of Measurement:
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

END OF SECTION 012200

SECTION 012300 - ALTERNATES

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 alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed for certain work that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other work of the Contract.

C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

END OF SECTION 012300

SECTION 012500 - 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.

B. Related Requirements:

1. Section 012100 "Allowances" for products selected under an allowance.
2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

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

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 in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies or one electronic (PDF format) copy of each request for consideration. Identify 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 CSI Form 13.1A or comparable form acceptable to Architect.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination 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 substitution 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, sustainable design characteristics, 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 and 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 substitution 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 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: Architect will consider requests for substitution if received prior to contractually establishing the Guaranteed Maximum Price (GMP) for the Project. Requests received after that time may be considered or rejected at discretion of Architect.

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 offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - 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.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect 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 Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 20 days, when not otherwise specified, 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 forms acceptable to Architect.

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 Architect.

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 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Contractor will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. 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 012600

SECTION 012900 - 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.

B. Related Requirements:

1. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
2. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
3. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

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.

1. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

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. Arrange schedule of values consistent with format of AIA Document G703.
2. 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. Change Orders (numbers) that affect value.
c. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

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

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
4. Round amounts to nearest whole dollar; total shall equal 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. If required, include evidence of insurance.

6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. 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.
8. Provide separate line items in the schedule for general overhead expense and Contractor's fee.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

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 paid for by Owner.

    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. 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.

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

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 Architect 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 liens 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. Copies of building permits.
5. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
6. Certificates of insurance and insurance policies.
7. Performance and payment bonds.
8. 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.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

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. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - 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. Requests for Information (RFIs).
4. Project meetings.

B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, 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, and telephone number 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 and telephone numbers, including home, office, and 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, on Project Web site, and by each temporary telephone. 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. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities 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.

C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown 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. Indicate functional and spatial relationships of components of architectural, structural, civil, fire protection, plumbing, mechanical, and electrical systems.
c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
e. Indicate required installation sequences.
f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate 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 ceiling plenum to accommodate layout of light fixtures 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, switch board, 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 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 changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."

1.7 REQUESTS FOR INFORMATION (RFIs)

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

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as 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 (Include building specific identification in Project name).
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. 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 Adobe Acrobat PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven calendar days for Architect's response for each RFI. RFIs received by Architect 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 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 012600 "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 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 monthly.

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

1.8 PROJECT MEETINGS

A. General: 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.
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 and Architect, within three days of the meeting.

B. Preconstruction Conference: 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. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner 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.
3. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Lines of communications.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for RFIs.
    g. Procedures for processing Applications for Payment.
    h. Submittal procedures.
    i. Use of the premises.
    j. Work restrictions.
    k. Working hours.
    l. Owner's occupancy requirements.
    m. Procedures for disruptions and shutdowns.
    n. Equipment deliveries and priorities.
    o. Security.
    p. Progress cleaning.

4. 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 that requires 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 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. Related RFIs.
    c. Related Change Orders.
    d. Purchases.
    e. Deliveries.
    f. Submittals.
    g. Possible conflicts.
    h. Compatibility requirements.
    i. Time schedules.
    j. Manufacturer's written instructions.
    k. Warranty requirements.
    l. Compatibility of materials.
    m. Acceptability of substrates.
    n. Temporary facilities and controls.
    o. Space and access limitations.
    p. Regulations of authorities having jurisdiction.
    q. Testing and inspecting requirements.
    r. Installation procedures.
    s. Coordination with other work.
    t. Required performance results.
    u. Protection of adjacent work.
    v. 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: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 30 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, 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. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at monthly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner 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) Status of submittals.
        4) Access.
        5) Temporary facilities and controls.
        6) Progress cleaning.
        7) Quality and work standards.
        8) Status of correction of deficient items.
        9) Status of RFIs.
        10) Status of proposal requests.
        11) Pending changes.
        12) Status of Change Orders.
        13) Pending claims and disputes.
        14) 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - 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. Contractor's construction schedule.
2. Construction schedule updating reports.
3. Daily construction reports.
4. Material location reports.
5. Site condition reports.
6. Special reports.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

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.

1.4 INFORMATIONAL SUBMITTALS

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

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.

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

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

D. Daily Construction Reports: Submit upon Architect’s request.

1.5 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.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.

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.

B. 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 011000 "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 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. Work Stages: Indicate important stages of construction for each major portion of the Work.
7. 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.

C. 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, and equipment required to achieve compliance, and date by which recovery will be accomplished.

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

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice of Award. 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.

2.3 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. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
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.

2.4 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: 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, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. 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. As the Work progresses, indicate final completion percentage for each activity.

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

END OF SECTION 013200

SECTION 013233 - 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. Periodic construction photographs.
3. Final completion construction photographs.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting photographic documentation.
2. Section 017700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.

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. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files monthly.

1. Digital Camera: Minimum sensor resolution of 8 megapixels.
2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
3. Identification: Provide the following information with each image description in file metadata tag:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect.
d. Name of Contractor.
e. Date photograph was taken.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
g. Unique sequential identifier keyed to accompanying key plan.

C. Construction Photographs: Submit one print of each photographic view monthly.

1.4 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

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

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

1. Date and Time: Include date and time in file name for each image.
2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

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

1. Flag construction limits before taking construction photographs.

D. Periodic Construction Photographs: Take 20 photographs monthly, 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.

E. Architect-Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

F. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.

1. Do not include date stamp.

G. Additional Photographs: Architect 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 to 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.

END OF SECTION 013233

SECTION 013300 - 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 requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect'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 responsive action. The Architect, at his discretion, may review the Informational Submittals for compliance with design intent. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals." Information submittals shall be submitted simultaneously by the Contractor to the Owner’s Consultant and to the Architect. The Owner’s Consultant shall be responsible for submittals requiring “responsive action”. Submittals may be rejected for not complying with requirements by the Owner’s Consultants.

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule 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 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: 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: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
    a. Submittal number (Indicate on each submittal, the related building component).
    b. Specification Section number.
    c. Description of the Work covered.
    d. Submittal Category: New or Resubmittal.
    e. Date received from Contractor.
    f. Name of Consultant/subcontractor.
    g. Date sent to Consultant/subcontractor.
    h. Date returned from Consultant/subcontractor.
    i. Action Taken: Approved, approved as noted, revise/resubmit, rejected/resubmit.
    j. Date returned to Contractor.

1.5 INFORMATIONAL SUBMITTALS

A. Informational Submittal Schedule: Submit informational submittals, arranged in chronological order by dates required by construction schedule, concurrent with Action Submittals. 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 the Owner’s Consultant and additional time for handling and reviewing submittals required by those corrections.

1. Informational submittals shall be submitted simultaneously by the Contractor to the Owner’s Consultant and to the Architect.
2. Coordinate submittal schedule with list of subcontracts, the schedule of values, Owner’s Consultant and Contractor's construction schedule.
3. Initial Submittal: List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
4. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
5. Format: Arrange the following information in a tabular format:
    a. Submittal number (Indicate on each submittal, the related building component).

b. Specification Section number.
c. Description of the Work covered.
d. Submittal Category: New or Resubmittal.
e. Date received from Contractor.
f. Name of Consultant/subcontractor.
g. Date sent to Consultant/subcontractor.
h. Date returned from Consultant/subcontractor.
i. Action Taken: Approved, approved as noted, revise/resubmit, rejected/resubmit.
j. Date returned to Contractor.

1.6 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Digital copies of the Contract Drawings will be provided in PDF or similar format by the Architect for Contractor's use in preparing submittals. The Architect shall also provide an unannotated copy of the Design Model geometry in the Authoring Software's native format (RVT).

1. Architect will furnish Contractor one set of digital drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

a. Contractor shall execute a data licensing agreement in the form of acceptable to Owner and Architect.
b. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

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

1. General Contractor shall provide a complete Submittal Schedule with anticipated submittal dates based on the design team specifications.
2. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
3. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
4. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
5. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves 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 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect 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 calendar 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 calendar 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 calendar days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal files as follows:

1. Assemble complete submittal package into a single PDF file incorporating submittal requirements of a single Specification Section and transmittal form.
2. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g. PERC-061000.01). Resubmittals shall include a sequential number after another decimal point (e.g. PERC-061000.01.01).

3. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software, or an electronic form acceptable to Architect containing the following information:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of firm or entity that prepared submittal.
    g. Names of subcontractor, manufacturer, and supplier.
    h. Category and type of submittal.
    i. Submittal purpose and description.
    j. Specification Section number and title.
    k. Specification paragraph number or drawing designation and generic name for each of multiple items.
    l. Drawing number and detail references, as appropriate.
    m. Location(s) where product is to be installed, as appropriate.
    n. Related physical samples submitted directly.
    o. Indication of full or partial submittal.
    p. Transmittal number.
    q. Submittal and transmittal distribution record.
    r. Other necessary identification.
    s. Remarks.

E. Options: Identify options requiring selection by Architect.

F. 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 action stamp.

G. 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.

H. 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 action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Post electronic submittals as PDF electronic files directly to Architect's FTP site specifically established for Project.
    a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
2. Informational Submittals: Post electronic submittals as PDF electronic files of each informational submittal unless otherwise indicated. Information submittals shall be submitted simultaneously by the Contractor to the Owner's Consultant and to the Architect.
    a. Architect will not return annotated file. Architect shall retain one copy of file as an electronic Project record document file.
3. Certificates and Certifications Submittals: Provide 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.
    a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.

B. 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 not suitable 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 showing 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 or concurrent with Samples.
6. Submit Product Data in the following format:
    a. PDF electronic file.

C. 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.

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. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least Insert dimensions.
3. Submit Shop Drawings in the following format:
    a. PDF electronic file.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.
    e. Specification paragraph number and generic name of each item.
3. 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.
4. 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 will return submittal with options selected.

5. 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 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.

E. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

J. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

K. 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.

L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

M. 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.

N. 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.

O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

Q. 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.

R. 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.

S. 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:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

T. 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.

U. 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 primers and substrate preparation needed for adhesion.

V. 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.

W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 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 Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three paper copies of certificate, 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.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action 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.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, 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.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

1. Final Unrestricted Release: Where the submittal is marked “Approved” the Work covered by the submittal may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.

2. Final-but-Restricted Release: Where the submittal is marked “Approved Corrected” the Work covered by the submittal may proceed provided it complies both with Architect’s notations and corrections on the submittal and the Contract Documents. Final acceptance will depend on that compliance.

3. Returned for Resubmittal: Where the submittal is marked “Disapproved” do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or

other activity for the product submitted. Revise or prepare a new submittal according to Architect's notations and corrections.

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

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

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

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000 - 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 inspecting 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 -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. 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.

B. 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. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.

2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. 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.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

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

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. 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, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" 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.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be 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.

1.5 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

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

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

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

C. 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.

D. Schedule of Tests and Inspections: Prepare in tabular form.

1.7 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, and telephone number 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 inspecting.
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, and telephone number 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 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, and telephone number 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 whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, 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 QUALITY ASSURANCE

A. General: 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.

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, 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 are similar in material, design, and extent to those indicated for this Project.

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

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

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according

to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

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 installation 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:

1. Contractor responsibilities include the following:
    a. Provide test specimens representative of proposed products and construction.
    b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, 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 in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven calendar days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
    a. Allow seven calendar days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Construct integrated exterior mockup according to Drawings and approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1. Mock-up installations shall be used as a standard for judging acceptability of work for Project. Replace unsatisfactory work as directed. Maintain sample installations during construction as a standard for judging acceptability of exterior wall work.
2. Size: Provide 1 full sized sample installation, 4’ x 12’ X 8’ tall and shall include roofing materials. Build sample installations built on site complete with glass, aluminum framing, windows, storefront framing with doors and glazing, adjacent cladding materials, anchors, connections, flashings, sealants and joint fillers as accepted on final shop drawings. Do not take special precautions or use techniques that do not represent those to be used on work. Do not enclose interior side of wall with interior finishes and insulation materials. Mock-up shall be completed and approved prior to the construction and ordering of materials.

1.9 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 inspecting 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, and the Contract Sum will be adjusted by Change Order.

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

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. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    a. Contractor shall 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 inspecting 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 inspecting 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. 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 013300 "Submittal Procedures."

D. 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.

E. 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.

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

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location 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 any duties of Contractor.

G. Associated Services: Cooperate with agencies 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 inspecting. 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 inspecting equipment at Project site.

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

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 as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

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 reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, 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 017300 "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 014000

SECTION 014150 - THRESHOLD INSPECTIONS

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. Description:

1. This Section includes the procedural requirements for quality assurance for Threshold Inspections.
2. Threshold Inspection and testing services are required to provide a detailed verification of compliance with the Construction Documents, codes and standards specified. Threshold Inspection services and the presence of Special Inspectors on site do not relieve the Contractor of responsibility for compliance with the Construction Document requirements.
3. The Registered Design Professional for Threshold Inspections is typically the Architect or Structural Engineer. Often the Architect will take input from the Structural, Mechanical and Electrical Engineers and act as the overall Registered Design Professional in Responsible Charge of preparing and submitting the Statement of Threshold Inspections.

B. Related Documents and Standards:

1. All Threshold Inspections on this project shall conform to the Construction Documents and the applicable building code including referenced standards, in addition to this document. The Threshold Inspections Package has been submitted as part of the Construction Documents. These documents describe Contractor responsibilities, Fabricator responsibilities, required inspections/testing and inspections/testing frequency.
2. Hold a Threshold Inspections preconstruction meeting at least 7 days prior to initial planned date for start of work requiring Threshold Inspections.
    a. Discussions shall include the following:
        1) Review of specifications and Schedule of Threshold Inspections for work requiring Threshold Inspections.
        2) Responsibilities of Contractor, Owner, Testing Agency, Special Inspector, and Registered Design Professional:
    b. Notification and reporting procedures:
3. Attendees shall include Contractor, Owner’s Representative, Testing Agency, Special Inspector, and Registered Design Professionals for Structural Engineering and Architecture

C. Related Sections:

1. Division 03 Specifications – Concrete Construction.
2. Division 04 Specifications – Masonry Construction.

3. Division 05 Specifications – Steel Construction.

1.3 QUALITY CONTROL

A. Threshold Inspections shall be performed by agents who have relevant experience for each category of inspections. Minimum qualifications and certifications for each category are indicated in the building code.

B. Threshold Inspections and Testing: Owner will engage an agency to conduct Threshold Inspections and Testing as described in the referenced Threshold Inspections documentation and as required by authorities having jurisdiction.

1. Special Inspector and his agents will notify Registered Design Professional and Contractor of deficiencies observed in the Work.
2. Special Inspector and his agents will submit a certified written report of each test, inspection and similar quality-control service.
3. Special Inspector and his agents will submit a Final Report of Threshold Inspections at the completion of the Threshold Inspections stating work was completed in substantial conformance with Construction Documents. Final Report of Threshold Inspections shall state required inspections have been performed and itemize nonconforming work not corrected or resolved as coordinated with the Design Professional in Responsible Charge. Final Report of Threshold Inspections is included with the Statements of Threshold Inspections for use by the Special Inspector(s) and his agents.
4. Special Inspector and his agents will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Construction Documents.
5. Special Inspector and his agents will retest and reinspect corrected work.
6. Owner’s selection of a Special Inspector in no way relieves the Contractor of responsibility to perform work in full compliance with Construction Documents.

1.4 Special Inspector and Agency Qualification Data: Inspection agencies shall submit a copy of their qualifications, including names and qualifications of each inspector and technician who will be performing inspections or tests, to the Code Enforcement Official. Special Inspector and Agency shall be acceptable to the Code Enforcement Official.

A. Reports: Special Inspectors shall submit inspection reports of each test or inspection to the Contractor, Architect of Record, Structural Engineer of Record, Design Professional in Responsible Charge, and the Owner. Reports to be submitted on forms approved by the Design Professional in Responsible Charge. All deficiencies shall be highlighted in reports and presence of deficiencies shall be noted within the report title.

B. Permits, Licenses, and Certificates: For Owner’s records, submit copies of certifications, inspection reports, releases, deficiencies, Architect/Engineer sketches regarding deficiencies, correspondence, records, and similar documents established for compliance with the Threshold Inspections program documented by the Threshold Inspection Statement and Schedule.

C. Owner shall provide all completed Threshold Inspection forms and schedule of Threshold Inspections to Special Inspector(s) with all Construction Documents and document changes.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 THRESHOLD INSPECTION FORMS

A. Statements of Threshold Inspections: The attached Statements of Threshold Inspections, completed by the registered Design Professional in Responsible Charge, shall be submitted to the Building Official at the time of permit application. Copies of the forms, approved by the Building Official, shall be kept by the Contractor at a central location on the project site and submitted to the Design Professional in Responsible Charge.

B. Schedule of Threshold Inspections: The Schedule of Threshold Inspections shall be submitted to the Building Official at the time of permit application. Special Inspectors shall initial and date each item in the “Completed” column when the inspections for the specific scope of work are completed. A copy of the Schedule of Threshold Inspections containing signatures for all tasks requiring inspection shall be submitted to the Design Professional in Responsible Charge with the Final Reports of Threshold Inspections.

C. Contractor’s Statement of Responsibility: Contractor shall review the Statements of Threshold Inspections and Schedule of Threshold Inspections. Contractor shall complete the Contractor Statement of Responsibility and submit the statement to the Design Professional in Responsible Charge.

D. Fabricator’s Certificate of Compliance: Contractor shall forward one copy of Fabricator’s Certificate of Compliance to each Fabricator who provides fabrication materials noted for Threshold Inspection in the schedule and who is exempt from Threshold Inspection per the following:

1. Threshold inspections are not required where the work is done on the premises of a fabricator registered and approved to perform such work without Threshold Inspection. Approval shall be based upon review of the fabricator’s written procedural and quality control manuals and periodic auditing of fabrication practices by an approved Threshold Inspection agency. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the building official stating that the work was performed in accordance with the approved construction documents. Contractor shall submit all Certificates to the Design Professional in Responsible Charge.

E. Final Report of Threshold Inspections: The Final Report of Threshold Inspections (blank report is submitted with the Statements of Threshold Inspections and Schedule, for reference) shall be submitted to the Building Official when all Threshold Inspection requirements for the project are completed and there are no outstanding deficiencies in work scheduled for inspections/testing. Each Threshold Inspection agency noted in the Schedule is required to submit a copy of this form for their scope of work.

3.2 OWNER RESPONSIBILTIES

A. Owner will engage and pay for services of Special Inspector and his agents.

B. Owner will engage either the Architect or one of his consultants to act as the Design Professional in Responsible Charge and pay for services of administrating this program.

C. The Design Professional will engage the services of the Special Inspector and his agents on behalf of GSFIC.

3.3 CONTRACTOR RESPONSIBILITIES

A. Contractor to whom building permit is issued shall have and maintain responsibility to manage, direct, and control construction activities on Project for which building permit is issued.

B. Contractor shall designate a representative who shall be the direct point-of-contact with the Special Inspector(s) during each phase of work. Designated representative will work with the Special Inspector(s) and Design Professional in Responsible Charge to communicate and coordinate for corrective actions required for discrepancies noted during work progress.

C. Contractor shall review the Schedule of Threshold Inspections to become familiar with all of the required testing and inspections and shall cooperate with Special inspector(s) to provide access to construction activities and manufacturer's operations that are to be tested/inspected.

D. Provide required copies of product test reports to Special Inspector(s).

E. Secure and deliver to Special Inspector(s) adequate quantities of representative material samples that require testing/inspection as part of the Schedule of Threshold Inspections.

F. Provide incidental labor and facilities:

1. To facilitate tests and inspections that are required by Threshold Inspections and noted in the Schedule of Threshold Inspections.
2. To provide access to construction activities to be tested.
3. To obtain and handle samples at Project site or at source of product to be tested.
4. For storage and curing of test samples.

G. Notify Special Inspector(s) and his agents at least 48 hours in advance of required inspection or test:

1. When tests or inspections cannot be performed after such notice, immediately notify Special Inspector to discuss alterations of work and subsequent inspection(s) to allow for required testing/inspection by Special Inspector(s).
2. If the Special Inspector is not notified in time to cancel and reschedule any required inspection, the Contractor shall reimburse Owner through Change Order procedure for Special Inspector(s) personnel and travel expenses incurred. Contractor, Special Inspector, and Owner shall develop procedures and associated costs for the Change Order procedure noted.

H. Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Construction Document requirements, regardless of whether original test was Contractor's responsibility.

I. Cost of construction related to retesting, deficiencies, corrective work, revised or replaced by Contractor, is Contractor's responsibility where required tests performed on original construction indicated noncompliance with Construction Document requirements.

J. Contractor shall be solely responsible for construction site safety.

3.4 SPECIAL INSPECTOR(S) RESPONSIBILITES

A. Review all Threshold Inspection statements and the Schedule of Threshold Inspections and become familiar with the structural design for the project and construction requirements, such that the Inspector(s) and his agents may provide adequate verification observations to assure conformance with Construction Documents.

B. Review Construction Documents and reference documents cited in sufficient detail that he may assure himself that conformance is provided.

C. Contact local Enforcement Agency/Building Official and Design Professional in Responsible Charge to determine requirements for testing/inspection report and nonconformance log formatting and frequency. Determine if all reporting will be transmitted to the Design Professional in Responsible Charge or if any of the reporting must also be transmitted directly from the Special Inspector(s) to the local Enforcement Agency/Building Official.

D. Consult with the Design Professional in Responsible Charge for clarification regarding questions from the site, deficiencies, and misinterpretations of the work.

E. Attend preconstruction meetings and routine job conferences called by Contractor.

F. Provide on-site testing, inspections, and observations of phases of work in accordance with frequencies noted for each type of inspection in the Schedule of Threshold Inspections and to assure himself Contractor is performing work in accord with Construction Documents.

G. Receive and review required Contractor submittals for verification of conformance to Construction Documents.

H. Provide local Enforcement Agency/Building Official and Design Professional in Responsible Charge with periodic Threshold Inspection reports, all testing/inspection documentation, and reports of outstanding/resolved nonconformances with report formats and report frequencies coordinated at the start of the Threshold Inspections program.

3.5 LIMITS ON AUTHORITY

A. Special Inspector and his agents shall not release, revoke, alter, or enlarge on requirements of Construction Documents.

B. Special Inspector and his agents shall not have control over Contractor’s means and methods of construction.

C. Special Inspector and his agents shall not have authority to stop work.

3.6 COMMUNICATION

A. Testing Agency shall immediately notify Contractor and Registered Design Professional by e-mail of test results or inspections failing to comply with requirements of the Construction Documents.

B. Special Inspector shall immediately notify Contractor of work found to be in nonconformance with the Construction Documents. If nonconforming work is not corrected while the Special Inspector is on-site, Special Inspector shall notify Registered Design Professional within 24 hours (one business day) and issue a nonconformance report.

C. If nonconforming work is not corrected at time of substantial completion of structure or other appropriate time, Special Inspector shall notify Code Enforcement Official.

D. Special Inspector and his agents submit reports within 7 days of inspection or test.

3.7 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample taking, and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.

B. Protect construction exposed by, or for, quality control service activities, and protect repaired construction.

C. Repair and protection is Contractor’s responsibility, regardless of assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 014150

SECTION 014200 - 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": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

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.

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 Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. 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. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

DIN	Deutsches Institut fur Normung e.V. www.din.de	49 30 2601-0
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543

C. 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. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
NCHRP	National Cooperative Highway Research Program (See TRB)	

NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PHS	Office of Public Health and Science http://www.hhs.gov/ophs/	(202) 690-7694
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

D. 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. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(866) 512-1800 (202) 512-1800
FTMS	Federal Test Method Standard (See FS)	

E. 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. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - 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.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

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

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

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

C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.

D. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

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 U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

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 1-5/8-inch OD top rails.

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 galvanized-steel bases for supporting posts.

C. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

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

B. 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. 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 and clean HVAC system as required in Section 017700 "Closeout Procedures".

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 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.

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

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.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users 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 municipal system as directed by authorities having jurisdiction.

C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash 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.

E. 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.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

G. 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.

H. 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.
2. Install lighting for Project identification sign.

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel.

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. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

2. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. 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. Traffic Controls: Comply with requirements of authorities having jurisdiction.

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

C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

1. On-site parking shall be limited to 15 vehicles at one time.

D. 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 touchup signs so they are legible at all times.

E. 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 017300 "Execution."

F. Temporary Elevator Use: Use of elevators is not permitted.

G. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

H. 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.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

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 011000 "Summary."

C. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6-mi polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
    a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
4. Insulate partitions to control noise transmission to occupied areas.
5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
6. Protect air-handling equipment.
7. Provide walk-off mats at each entrance through temporary partition.

D. Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 311000 "Site Clearing."

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 environmentally safe materials.

G. 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 work day.

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

I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

K. 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.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to 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.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Partially Enclosed Construction Phase: 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, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

C. Controlled Construction Phase of Construction: 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 permanent HVAC system to control humidity.
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.
    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 materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 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.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

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

E. 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 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 015639 - TEMPORARY TREE AND PLANT 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 general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Sections:

1. Section 015000 "Temporary Facilities and Controls" for temporary site fencing.
2. Section 311000 "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches above the ground for trees up to, and including, 4-inch size; and 12 inches above the ground for trees larger than 4-inch size.

B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings or defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of the following:

1. Organic Mulch: 1-pint volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.
3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

D. Qualification Data: For qualified arborist and tree service firm.

E. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

F. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

G. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.5 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by ISA.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
b. Enforcing requirements for protection zones.
c. Arborist's responsibilities.
d. Field quality control.

1.6 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.

7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other nonsoil materials.

1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.

B. Topsoil: Stockpiled topsoil from location shown on Drawings.

C. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood or pine straw.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural.

D. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements. Previously used materials may be used when approved by Architect.

1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch- diameter wire chain-link fabric; with 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 rails** and 0.177-inch-diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

a. Height: 6 feet.

2. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet apart.

a. Height: 4 feet.
b. Color: High-visibility orange, nonfading.

3. Gates: Double swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.

E. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

1. Size and Text: Tree Protection Area.
2. Lettering: 3-inch- high minimum, black characters on white background.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 TREE- AND PLANT-PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
3. Access Gates: Install where needed; adjust 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. Tree Protection Fencing Approval: Contractor shall install tree protection fencing prior to clearing the site and as indicated on the drawings and shall obtain the Architect’s written approval prior to clearing the site.

C. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 35 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.

D. Maintain protection zones free of weeds and trash.

E. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

F. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.3 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving."

B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.4 ROOT PRUNING

A. Prune roots that are affected by temporary and permanent construction. Prune roots as directed by Arborist or as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Coat cut ends of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune roots 12 inches inside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.5 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by Arborist or as follows:

1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
2. Pruning Standards: Prune trees according to ANSI A300 (Part 1) and the following:

    a. Type of Pruning: Cleaning, Thinning, Raising, and Reduction.
    b. Specialty Pruning: Restoration, Vista, and Utility.

3. Cut branches with sharp pruning instruments; do not break or chop.
4. Do not apply pruning paint to wounds.

B. Chip removed branches and dispose of off-site.

3.6 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.7 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.8 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed root cutting and tree and shrub repairs.
2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
4. Perform repairs within 24 hours.
5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size and species as those being replaced for each tree that measures 6 inches or smaller in caliper size.
2. Trees being replaced that are 6” and larger in caliper size: Provide one new tree 4” in caliper size at the quantity calculated by dividing the existing tree caliper by 4.

a. Species: Species selected by Architect.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 016000 - 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.

B. Related Requirements:

1. Section 012100 "Allowances" for products selected under an allowance.
2. Section 012300 "Alternates" for products selected under an alternate.
3. Section 012500 "Substitution Procedures" for requests for substitutions.
4. Section 014200 "References" for applicable industry standards for products specified.

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. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process 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 specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

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. Substitution of comparable products for Contractor's convenience will be considered in accordance with Section 012500 “Substitution Procedures”.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 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. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between 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-connected 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.

3. See individual identification sections in Divisions 21, 22, 23, and 26 for additional identification requirements.

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 to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. 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 warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for 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 with the Specifications, 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 017700 "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 not in conflict with 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.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the product listed that complies with requirements. Substitution of comparable products for Contractor's convenience will be considered in accordance with Section 012500 “Substitution Procedures”.

    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. Substitution of comparable products for Contractor's convenience will be considered in accordance with Section 012500 “Substitution Procedures”.

    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. Substitution of comparable products for Contractor's convenience will be considered in accordance with Section 012500 “Substitution Procedures”.

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

4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed. Substitution of an unnamed product, which complies with requirements of comparable products for Contractor's convenience will be considered in accordance with Section 012500 “Substitution Procedures”.

    a. Non-limited list of products is indicated by the phrase: "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following: …"

5. 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. Substitution of comparable products for Contractor's convenience will be considered in accordance with Section 012500 “Substitution Procedures”.

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

6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements. Substitution of comparable products for Contractor's convenience will be considered in accordance with Section 012500 “Substitution Procedures”.

    a. Non-limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following: …"

7. 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 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.

C. Visual Matching Specification: Where Specifications require "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 012500 "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 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: 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 these requirements:

1. For approval of comparable products, comply with the requirements in Section 012500 “Substitution Procedures” for substitutions for convenience.
2. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
3. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
4. Evidence that proposed product provides specified warranty.
5. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
6. Samples, if requested.

B. Submittal Requirements: 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.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - 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-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

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

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

1.4 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site.

1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting

and patching work. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:

a. Contractor's superintendent.
b. Trade supervisor responsible for cutting operations.
c. Trade supervisor(s) responsible for patching of each type of substrate.
d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affecting by cutting and patching operations.

2. 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.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. 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.

D. 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.

F. Certified Surveys: Submit two copies signed by land surveyor.

G. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.6 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. 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, 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. Mechanical systems piping and ducts.
f. Control systems.
g. Communication systems.
h. Fire-detection and -alarm systems.
i. Conveying 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. Sprayed fire-resistive material.
d. Equipment supports.
e. Piping, ductwork, vessels, and equipment.
f. Noise- and vibration-control elements and systems.

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.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. 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.

C. 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.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

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

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. 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.

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "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. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story 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 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.

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. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect 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 to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by 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, existing improvements 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. General: 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.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

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 the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

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

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

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

H. 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.

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.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

K. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, 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. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. 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.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. 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.

H. 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. 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 minimize 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. 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.

I. 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 OWNER-INSTALLED PRODUCTS

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

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

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 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. General: 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.

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 in Finished Areas: 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 015000 "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 assure 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 014000 "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.

END OF SECTION 017300

SECTION 017419 - 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 SUMMARY

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

1. Recycling nonhazardous demolition and construction waste.
2. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
2. Section 042613 "Masonry Veneer" for disposal requirements for masonry waste.
3. Section 044313.13 "Anchored Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
4. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:

a. Asphalt paving.
b. Concrete.
c. Concrete reinforcing steel.
d. Brick.
e. Concrete masonry units.
f. Wood studs.
g. Wood joists.
h. Plywood and oriented strand board.
i. Wood paneling.
j. Wood trim.
k. Structural and miscellaneous steel.
l. Rough hardware.
m. Roofing.
n. Insulation.
o. Doors and frames.
p. Door hardware.
q. Windows.
r. Glazing.
s. Metal studs.
t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.
y. Equipment.
z. Cabinets.
aa. Plumbing fixtures.
bb. Piping.
cc. Supports and hangers.
dd. Valves.
ee. Sprinklers.
ff. Mechanical equipment.
gg. Refrigerants.
hh. Electrical conduit.
ii. Copper wiring.
jj. Lighting fixtures.
kk. Lamps.
ll. Ballasts.
mm. Electrical devices.
nn. Switchgear and panelboards.
oo. Transformers.

2. Construction Waste:

a. Masonry and CMU.
b. Lumber.

c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Roofing.
g. Insulation.
h. Carpet and pad.
i. Gypsum board.
j. Piping.
k. Electrical conduit.
l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For waste management coordinator and refrigerant recovery technician.

H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator. Waste management coordinator may also serve as LEED coordinator.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Use. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each

type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in hauling and tipping fees by donating materials.
7. Savings in hauling and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:

C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

D. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

E. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.

1. Crush asphaltic concrete paving and screen to comply with requirements in Section 312000 "Earth Moving" for use as general fill.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch size.
2. Crush concrete and screen to comply with requirements in Section 312000 "Earth Moving" for use as satisfactory soil for fill or subbase.

D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum 3/4-inch size.

a. Crush masonry and screen to comply with requirements in Section 312000 "Earth Moving" for use as general fill satisfactory soil for fill or subbase.
b. Crush masonry and screen to comply with requirements in Section 329300 "Plants" for use as mineral mulch.

2. Clean and stack undamaged, whole masonry units on wood pallets.

E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

F. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

J. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

K. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

L. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

N. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.

4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
    a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
    a. Comply with requirements in Section 329300 "Plants" for use of clean ground gypsum board as inorganic soil amendment.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.

E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - 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.
5. Repair of the Work.

B. Related Requirements:

1. Section 017300 "Execution" for progress cleaning of Project site.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 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 individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
3. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
4. Submit test/adjust/balance records.
5. 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.
6. Advise Owner of changeover in heat and other utilities.
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, including touchup painting.
10. Touch up 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 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. Reinspection: 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.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
2. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
3. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
    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 Architect's signature for receipt of submittals.
4. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
5. 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.
6. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
7. Submit pest-control final inspection report.

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 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. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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. Use CSI Form 14.1A or comparable form acceptable to Architect.

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for ceiling, 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.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:

    a. MS Excel electronic file. Architect, through Construction Manager, will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

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.

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.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - 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.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and 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. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed 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 operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

2. One paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.

C. 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.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. 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.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

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."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: 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.

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. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. 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.

C. 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.

D. 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.

2.4 OPERATION MANUALS

A. 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.

B. 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.

C. 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.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. 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.

B. 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.

C. 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.

D. 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.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. 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.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. 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 warranty and bond information, as described below.

B. 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.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.

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.

D. 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.

E. 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.

F. 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.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. 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 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. 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.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

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.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, 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.

1. 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.

F. 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 operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - 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.

B. Related Requirements:

1. Section 017300 "Execution" for final property survey.
2. Section 017700 "Closeout Procedures" for general closeout procedures.
3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

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 one paper-copy set(s) of marked-up record prints.
        2) 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 and three set(s) of prints.
        2) Print each drawing, 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 monthly 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.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the 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 archive 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 below first floor.
    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 sets 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. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
3. 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.
4. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

2.2 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 scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. 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.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 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 scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

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. Maintenance of Record Documents and Samples: Store record documents and Samples 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 reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - 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. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.

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.

B. Qualification Data: For instructor.

1.4 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 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 has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 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. Operations manuals.
   c. Maintenance manuals.
   d. Project record documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. 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.

PART 3 - EXECUTION

3.1 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 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish an instructor to describe Owner's operational philosophy.
2. Owner will furnish Contractor with names and positions of participants.

B. 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 with at least seven days' advance notice.

C. 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.

D. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

SECTION 033000 - CAST-IN-PLACE CONCRETE

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. Description:

1. This section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

a. Footings.
b. Slabs-On-Grade.
c. Suspended Slabs.
d. Concrete Toppings.
e. Building Frame Members.
f. Building Walls.

B. Related Documents and Standards:

1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
2. All cast-in-place concrete work on this project shall conform to the Construction Documents, applicable building code including referenced standards, the requirements of “Specification for Structural Concrete” ACI 301-16 (Chapters 1-5, & Chapters 6-14 as applicable) and "Specifications for Tolerances for Concrete Construction and Materials" ACI 117, in coordination with clarifications, exemptions, and additions in the Construction Documents.

C. Related Sections:

1. Division 03 Specifications – Concrete Construction.
2. Division 07 Specifications – Thermal and Moisture Protection.
3. Division 31 Specifications – Earthwork.

1.3 QUALITY ASSURANCE

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 cast-in-place 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. Concrete subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.4 SUBMITTALS

A. Design Mixtures:

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

B. Cold-Weather Placement: Submit detailed procedures for cold weather concreting in accordance with ACI 306.1.

C. Hot-Weather Placement: Submit detailed procedures for hot weather concreting in accordance with ACI 305.1.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

E. Formwork layout and dimension shop drawings.

F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates

G. Material Certificates: For each of the following as applicable on the project, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semirigid joint filler.
13. Joint-filler strips.
14. Repair materials.

H. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

I. Minutes of preinstallation conference.

1.5 INFORMATION SUBMITTALS

A. Formwork Shop Drawings: Signed and sealed by a Licensed Design Engineer in the state in which the project is located.

1. Calculations for Formwork, Shoring, Reshoring, and Backshoring: Signed and sealed by a Licensed Design Engineer in the state in which the project is located.

B. Embed and Penetration Plans: Submit placing drawings that detail locations of mechanical, electrical, plumbing, and fire protection openings, sleeves and embedded accessories not specifically located on the Structural Construction Drawings, including routing of embedded conduit.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Comply with ACI 301.

B. Earth forms may be used for footing forms where sides of the excavation are cut true, in firm soil. If earth is not suitable to be used as “earth form,” no consideration will be given to any claim for additional cost of formwork. Contractor shall provide material and labor to provide formwork without additional cost to Owner.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615 Grade 60 deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706 Grade 60 deformed.

1. For use where weldable reinforcing is called out in construction documents.

C. Epoxy-Coated Reinforcing Bars: ASTM A 615 Grade 60 deformed bars, ASTM A 775 or ASTM A 934, epoxy coated, with less than 1 percent damaged coating in each 12-inch bar length.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.

E. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884, Class A coated, Type 1, plain steel.

F. Headed Concrete Anchors: Conform to AWS D1.1 and ASTM A 108 specifications for 1010 through 1020 mild steels, type B. Minimum yield strength = 51,000 psi (0.2 % offset).

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, ASTM A 775 epoxy coated.

C. Bar Supports: Manufacture bar supports from plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete for use in foundations and slabs-on-grade only.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I, or Type II for moderate sulfate resistance (when required) and Type III for high-early strength (when required). Supplement with the following:
   a. Fly Ash: ASTM C 618, Class F or C.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
   c. Use of supplemental cementitious materials may be rejected by Architect/Structural Engineer of Record for certain applications on project.

2. Blended Hydraulic Cement: ASTM C 595, Type IS portland blast-furnace slag, Type IP portland-pozzolan, Type I (PM) pozzolan-modified Portland, Type I (SM) slag-modified portland cement. Use of blended hydraulic cement may be rejected by Architect/Structural Engineer of Record for certain applications on project.

B. Silica Fume: ASTM C 1240, amorphous silica. Use of blended hydraulic cement may be rejected by Architect/Structural Engineer of Record for certain applications on project.

C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Select grading class per type of construction or location used, and in relation to specific weathering region. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: See schedule on Construction Drawings.

D. Water: Shall be potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 FIBER REINFORCEMENT

A. Fiber reinforcement may be requested for substitution by contractor. Architect/Structural Engineer of Record shall review for compliance any substitution requested and approve or reject as necessary.

2.7 WATERSTOPS

A. Coordinate with Division 07 specifications and architectural drawings for waterstop requirements.

2.8 VAPOR RETARDERS

A. Sheet Vapor Retarder meeting ASTM E 1745, minimum 10 mil thickness. Coordinate with Division 03 and 07 specifications and Architectural Drawings for additional requirements or increased thickness. See Construction Drawings for locations required. Install per qualified geotechnical engineer’s recommendation and ACI 302.1 requirements.

2.9 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 and ACI 318 chapter 5. Design mixtures shall meet the minimum requirements tabulated in the construction documents.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed. Requirements of table 4.1.2.9 of ACI 301 shall be adhered to.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, plasticizing, or retarding admixtures in concrete, as required, for placement and workability, and project specific conditions.

2.10 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI’s “Manual of Standard Practice.”

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete:

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for exposed smooth-formed finished surfaces.
2. Class B, 1/4 inch for exposed rough-formed finished surfaces.

3.2 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Field bending or straightening of reinforcing bars partially embedded in concrete is prohibited unless specifically permitted by Structural Engineer of Record. Comply with ACI 301 procedures for field bending and straightening.

C. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least two full panels. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.3 CONCRETE PLACEMENT

A. Do not add water to concrete during delivery or at Project site. Add water at project site only as noted on delivery ticket, and prior to beginning placement.

B. Cold-Weather Placement: Comply additionally with ACI 306.1 and as follows:

1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

C. Hot-Weather Placement: Comply additionally with ACI 305.1 and as follows:

1. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.

3.4 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish:

1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

C. Trowel Finish (after applying float finish):

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
    b. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.

D. Trowel and Fine-Broom Finish:

1. Apply a trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.

1. Coordinate required final finish with Architect before application.

3.5 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 301, ACI 305, ACI 306, and ACI 306.1 as applicable.

B. Cure concrete according to ACI 308.1, by one or a combination of the methods allowed in ACI 301.

3.6 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect/Structural Engineer of Record. Remove and replace concrete that cannot be repaired and patched to Architect/Structural Engineer of Record approval.

B. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning per ACI 301, to the satisfaction of the Architect/Structural Engineer of Record.

C. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. For areas out of tolerance or specification, Contractor shall propose correction method to Architect/Structural Engineer of Record for approval.

3.7 FIELD QUALITY CONTROL

A. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample set for each 75 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of delivery for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
4. Air Content: ASTM C231 or ASTM C173 as applicable, one test for each composite sample, but not less than one test for each day’s pour of each concrete mixture.
5. Compression Test Specimens: ASTM C 31.

    a. Cast and cure a minimum of four 6”x12” or five 4”x8” cylinder specimens for each composite sample.
    b. Additional cylinders to be cast for high-early strength concrete and as required for contractor’s means and methods.

6. Compressive-Strength Tests: ASTM C 39; test one specimen at 7 days and one set of two (6”x12”)/three (4”x8”) specimens at 28 days. Should 28 day strength not be met, test remaining cylinder at 56 days. Should 28 day strength be met, remaining cylinder may be discarded. Additional tests for high-early strength concrete and as required for contractor’s means and methods.

B. Measure floor and slab flatness and levelness according to ASTM E 1155 as soon as possible but within 24 hours of finishing. Elevated framing shall be measured in its shored condition (where applicable).

END OF SECTION 033000

SECTION 033519 – CONCRETE STAINING

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. Water-Based concrete stain for concrete surfaces.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product specified, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Samples for Concrete Color Selection: Manufacturer's color chart or sample chip set; indicating color number and application rate. Submittals are for general verification of color and may vary somewhat from concrete finished in field.

C. Samples for Verification of Precast Concrete: Three samples, 2 by 2 feet (610 by 610 mm) indicating concrete color range, texture, and uniformity.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 10 years of documented experience producing the specified products.

B. Installer Qualifications: An installer with 5 years’ experience with work of similar scope and quality.

C. Material Source: Obtain each specified material from the same source.

D. Notification: Give a minimum 7 calendar days' notice to manufacturer's authorized field representative before date established for commencement of work.

E. Mock-Up: Provide a mock-up for evaluation of consistent color and visual appearance of colored concrete.

1. Coordinate mock-up requirements with mock-ups specified in other sections; same mock-up may be used for more than one purpose.
2. Construct at least one month before start of colored concrete work, using materials and methods to be used in actual work.
3. Locate mock-ups on site in areas designated by Architect. Mock-up shall be:
   a. 4 feet by 4 feet.
4. Retain samples of all materials used in each mock-up for comparison purposes.
5. Mock-up may remain and be utilized in the work.
6. Remove mock-up when no longer required for comparison with finished work.

F. Preconstruction Conference: Conduct a review of procedures required to produce specified results.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's instructions.

B. Deliver to site or batch plant in original, unopened packaging. Store in dry conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Provide products specified herein manufactured by Sika Scofield (L.M. Scofield).

2.2 MATERIALS

A. Basis of Design Water-Based Concrete Stain: LITHOCHROME Tintura is a high performance, self-priming, low-odor, reactive polymer stain for use on interior or exterior, vertical or horizontal concrete and other cementitious surfaces that is designed for use as a primer/basecoat beneath clear solvent or waterborne acrylic, urethane, or epoxy sealers.

1. Description: A unique self-crosslinking system of acrylic and inorganic silicate polymers that penetrate, strengthen, and tightly bind color to cementitious surfaces.
2. Conformance: VOC compliant with applicable air quality management regulations. Less than 100 g/L VOC content
3. Colors: As selected by the Architect from the manufacturer's full range.
4. Compatible Sealers: As recommended in writing by the Manufacturer

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Stain must only be used on dry concrete that is above grade or on ground that is well-drained. Do not use on damp concrete, concrete slabs on damp ground, or on concrete that will be constantly exposed to moisture.

D. If recommended by the manufacturer, perform a Moisture Vapor Emission Rate (MVER) test of the concrete or cementitious substrate. The MVER must be less than 5 pounds per 1000 square feet per 24 hours for successful application of LITHOCHROME Chemstain Classic and sealing with SCOFIELD Selectseal Plus.

E. Protect adjacent surfaces with plastic sheeting during color staining and sealing.

3.3 APPLICATION

A. Water-Based Concrete Stain: Apply LITHOCHROME Tintura as recommended by the manufacturer to achieve the color and finish required to match the approved mock-up.

1. Apply by brush, roller, HVLP, airless, or pump-spray application. Remove overspray immediately with hot water and industrial detergent. Dried material will be difficult to remove.
2. Stain is designed to penetrate surfaces. If applied heavily over tape, it will crawl and stain under the tape. When tape masking is used, spray application of multiple light coats is recommended.
3. Apply additional coats if required to produce artistic effects required to match the approved mock-up. Allow to dry for at least 12 hours before application of sealer.
4. All chemically stained surfaces must be protected from traffic until they are sealed.
5. Apply sealer as recommended by the manufacturer at the rate required to match the mock-up.

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 033519

SECTION 033816 - POST TENSIONING REINFORCEMENT FOR CONCRETE

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. Description:

1. This Section includes the requirements for the following:

a. Furnishing post-tensioning reinforcement and accessories including encapsulated prestressing tendons, pocket formers, support bars, bar chairs, and slab bolsters.
b. Installing post-tensioning tendons.
c. Performing post-tensioning operations including stressing and finishing tendons.
d. Recording tendon elongations and gage pressures.
e. Finishing tendon ends and patching stressing pockets.

B. Related Documents and Standards:

1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Documents.

2. All post tensioning reinforcement work on this project shall conform to the Construction Documents, applicable building code including referenced standards, and all of the requirements of “Specification for Unbonded Single-Stand Tendon Materials and Commentary” ACI-423.7 with clarifications, exemptions, and additions in the Construction Documents.

C. Related Sections:

1. Division 03 Specifications – Concrete Construction.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer whose full-time Project superintendent has successfully completed PTI's Level 1 - Field Fundamentals course or has equivalent verifiable experience and knowledge acceptable to Architect.

1. Superintendent must have received training from post-tensioning supplier in the operation of stressing equipment to be used on Project.

B. Manufacturer Qualifications: Fabricating plant certified by PTI according to procedures set forth in PTI's "Manual for Certification of Plants Producing Unbonded Single Strand Tendons.”

C. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Testing Agency Inspector: Personnel performing field inspections and measuring elongations shall have successfully completed PTI's Level 2 Unbonded PT Inspector program or shall have equivalent qualifications acceptable to Architect.

D. Source Limitations: Obtain post-tensioning materials and equipment from the same supplier.

1. Stressing jacks must be calibrated and approved for use on Project by post-tensioning supplier.

E. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to installation and stressing of post-tensioning tendons including, but not limited to, the following:

a. Construction schedule and availability of materials, personnel, and equipment needed to make progress and avoid delays.
b. Storage of post-tensioning materials on-site.
c. Structural load limitations.
d. Coordination of post-tensioning installation drawings and nonprestressed reinforcing steel placing drawings.
e. Horizontal and vertical tolerances on tendon and nonprestressed reinforcement placement.
f. Marking and measuring of elongations.
g. Submittal of stressing records and requirements for tendon finishing.
h. Removal of formwork.

2. Review special inspection and testing and inspecting agency procedures.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Post-tensioning coating.
2. Tendon sheathing.
3. Anchorage devices.
4. Tendon couplers.
5. Bar and tendon supports.
6. Pocket formers.
7. Sheathing repair tape.
8. Stressing-pocket patching material.
9. Encapsulation system.

B. Shop Drawings: Installation drawings including plans, elevations, sections, details, and notes prepared by or under the supervision of a registered professional engineer detailing tendon layout and installation procedures, including the following:

1. Numbers, arrangement, and designation of post-tensioning tendons.
2. Tendon profiles and method of tendon support including chair heights and locations. Show tendon profiles at sufficient scale to clearly indicate all support points, with their associated heights.

3. Construction joint locations, pour sequence, locations of anchorages and blockouts required for stressing.
4. Stressing procedures and jacking force to result in final effective forces used in determining number of tendons required.
5. Signed and sealed calculations prepared by a registered design professional in the state in which the project is located indicating method of elongation calculation including values used for friction coefficients, anchorage seating loss, elastic shortening, creep, relaxation, and shrinkage. Comply with ACI 318 limits on stresses at transfer of prestress and under service load.
6. Calculated elongations for each tendon.
7. Details for horizontal curvature around openings and at anchorages.
8. Details for corners and other locations where tendon layouts may conflict with one another or nonprestressed reinforcing steel.
9. Diagrams and notes as necessary for positioning of nonprestressed reinforcement required for installing post-tensioning tendons including, but not limited to, the following.

    a. Support bars.
    b. Backup bars and hairpins at anchorages.
    c. Hairpins at locations of horizontal curvature
    d. Supplemental reinforcement at blockouts.

C. Product Certificates:

1. For each type of anchorage device and coupler, signed by product manufacturer.
2. For each type of encapsulation system, signed by product manufacturer.

D. Qualification Data. For manufacturer, installer, and testing agency. Include resume of individual supervising installation and stressing of post-tensioning tendons.

E. Mill Test Reports: Certified mill test reports for prestressing strand used on Project indicating that strand is low-relaxation and including the following:

1. Coil numbers or identification.
2. Breaking load.
3. Load at 1 percent extension.
4. Elongation at failure.
5. Modulus of elasticity.
6. Diameter and net area of strand.

F. Field quality-control test reports.

G. Procedures Statement: Procedures for cutting excess strand tail and patching stressing pocket.

H. Stressing Jack Calibration: Calibration certificates for jacks and gages to be used on Project. Calibrate each jack-and-gage set as a pair.

I. Stressing Records: Filled out by testing agency during stressing operation with the following information recorded:

1. Name of Project.
2. Date of approved installation drawings used for installation and stressing.
3. Floor number and concrete placement area.
4. Date of stressing operation.
5. Weather conditions including temperature and rainfall.
6. Name and signature of inspector.

7. Name of individual in charge of stressing operation.
8. Serial or identification numbers of jack and gage.
9. Date of jack-and-gage calibration certificates.
10. Gage pressure to achieve required stressing force per supplied calibration chart.
11. Tendon identification mark.
12. Calculated tendon elongation.
13. Actual tendon elongation.
14. Percentage deviation from calculated elongation.
15. Actual gage pressure

J. Minutes of preinstallation conference.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle post-tensioning materials according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons.

B. Inspect tendons and accessory items at time of their delivery to Project site, prior to off-loading. Notify post-tensioning supplier of observed damage prior to off-loading.

C. Keep accurate and current records of materials delivered and used.

D. Immediately remove from Project site any tendons with damaged strand.

1.6 COORDINATION

A. Attachments and Penetrations:

1. Attach permanent fixtures such as curtain-wall systems, handrails, fire-protection equipment, lights, and security devices to the slab using embedded anchors. Drilled anchors are not allowed unless authorized in writing by Architect/Structural Engineer of Record.
2. Powder-driven fasteners with an embed exceeding 5/8 inches are not allowed unless authorized in writing by Architect/Structural Engineer of Record.
3. Core drilling for sleeves or other penetrations is not allowed unless authorized in writing by Architect/Structural Engineer of Record.

B. Protect penetrations within 18 inches of an anchorage with ASTM A 53, Schedule 40 steel pipe.

PART 2 - PRODUCTS

2.1 PRESTRESSING TENDONS

A. Prestressing Strand: ASTM A 416, Grade 270 uncoated 7-wire, low-relaxation, 0.5-inch-diameter strand.

B. Post-Tensioning Coating: Compound with friction-reducing, moisture-displacing, and corrosion-inhibiting properties specified in ACI 423.6; chemically stable and nonreactive with prestressing steel, nonprestressed reinforcement, sheathing material, and concrete.

1. Minimum Coating Weight: 2.5 lb. for 0.5-inch-diameter strand per 100 feet of strand.
2. Completely fill annular space between strand and sheathing over entire tendon length with post-tensioning coating.

C. Tendon Sheathing: Comply with ACI 423.6.

1. Minimum Thickness: 0.050 inch for polyethylene or polypropylene with a minimum density of 0.034 lb. /cu. In.
2. Continuous over the entire length of tendon to provide watertight encapsulation of strand and between anchorages to prevent intrusion of cement paste or loss of coating for a non-encapsulated system.

D. Anchorage Device and Coupler Assembly: Assembly of strand, wedges, and anchorage device or coupler complying with static and fatigue testing requirements in ACI 423.6 and capable of developing 95 percent of actual breaking strength of strand.

1. Anchorage Bearing Stresses: Comply with ACI 423.6 for stresses at transfer load and service load.
2. Fixed-End Anchorage Device Assemblies: Plant fabricated with wedges seated at a load of not less than 80 percent and not more than 85 percent of breaking strength of strand.

E. Encapsulation System: Watertight encapsulation of prestressing strand consisting of the following:

1. Wedge-Cavity Caps: Attached to anchorages with a positive mechanical connection and completely filled with post-tensioning coating.
    a. Caps for Fixed and Stressing-End Anchorages Devices: Designed to provide watertight encapsulation of wedge cavity. Sized to allow required extension of strand past the wedges.
        1) Attach cap for fixed-end anchorage device in fabricating plant.
    b. Caps at Intermediate Anchorages: Open to allow passage of strand.
2. Sleeves: Attached to anchorage device with positive mechanical connection; overlapped a minimum of 4 inches with sheathing and completely filled with post-tensioning coating.

2.2 NONPRESTRESSING BARS

A. Support Bars, Reinforcing Bars, Hairpins: ASTM A 615, Grade 60, deformed. Minimum support bar size is 1/2 inch.

B. Epoxy-Coated Support Bars, Reinforcing Bars, Hairpins: ASTM A 615, Grade 60, deformed bars, ASTM A 775 or A 934 epoxy coated with less than 1 percent damaged coating in each 12-inch length of bar.

1. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on bars and complying with ASTM A 775. Repair damaged areas according to ASTM D 3963.

C. Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening tendons and tendon support bars in place. Manufacture bar supports, according to CRSI's "Manual of Standard Practice," from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows.

1. For uncoated bars, use all-plastic bar supports.
2. For epoxy-coated bars, use all-plastic bar supports.

D. For zinc-coated bars, use all-plastic bar supports.

2.3 ACCESSORIES

A. Pocket Formers: Capable of completely sealing wedge cavity; sized to provide the required cover over the anchorage and allow access for cutting strand tail.

B. Anchorage Fasteners: Galvanized steel nails, wires, and screws used to attach anchorage devices to formwork.

C. Sheathing Repair Tape: Elastic, self-adhesive, moistureproof tape with minimum width of 2 inches, in contrasting color to tendon sheathing; nonreactive with sheathing, coating, or prestressing steel.

2.4 PATCHING MATERIALS

A. Patching Material: One component, polymer-modified, premixed patching material containing selected silica aggregates and portland cement, suitable for vertical and overhead application. Do not use material containing chlorides or other chemicals known to be deleterious to prestressing steel or material that is reactive with prestressing steel, anchorage device material, or concrete.

PART 3 - EXECUTION

3.1 FORMWORK

A. Provide formwork for post-tensioned elements as specified in Division 03 Section 03 30 00. Design formwork to support load redistribution that may occur during stressing operation. Ensure that formwork does not restrain elastic shortening, camber, or deflection resulting from application of prestressing force.

B. Do not remove forms supporting post-tensioned elements until tendons have been fully stressed and elongations have been approved by Architect/Structural Engineer of Record.

C. Do not place concrete in supported floors until tendons on supporting floors have been stressed and elongations have been approved by Architect/Structural Engineer of Record.

3.2 NONPRESTRESSED STEEL REINFORCEMENT PLACEMENT

A. Placement of nonprestressed steel reinforcement is specified in Division 03 Section 03 30 00. Coordinate placement of nonprestressed steel reinforcement with installation of post-tensioning tendons.

3.3 TENDON INSTALLATION

A. Install tendons according to approved installation drawings and procedures stated in PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."

B. Tendon Supports: Provide continuous slab bolsters or bars supported on individual high chairs spaced at a maximum of 42 inches o.c. to ensure tendons remain in their designated positions during construction operations and concrete placement:

1. Support tendons as required to provide profiles shown on installation drawings. Position supports at high and low points and at intervals not exceeding 48 inches. Ensure that tendon profiles between high and low points are smooth parabolic curves.
2. Attach tendons to supporting chairs and reinforcement without damaging tendon sheathing.
3. Support slab tendons independent of beam reinforcement.

C. Maintain tendon profile within maximum allowable deviations from design profile as follows:

1. 1/4 inch for member depth less than or equal to 8 inches.
2. 3/8 inch for member depth greater than 8 inches and less than or equal to 24 inches.
3. 1/2 inch for member depth greater than 24 inches.

D. Maintain minimum radius of curvature of 500-strand diameters for lateral deviations to avoid openings, ducts, and embedded items. Maintain a minimum of 2 inches of separation between tendons at locations of curvature.

E. Limit tendon bundles to five tendons. Do not twist or entwine tendons within a bundle. Maintain a minimum distance of 12 inches between centers of adjacent bundles.

F. If tendon locations conflict with nonprestressed reinforcement or embedded items, tendon placement governs unless changes are authorized in writing by Architect/Structural Engineer of Record. Obtain Architect/Structural Engineer of Record approval before relocating tendons or tendon anchorages that interfere with one another.

G. Deviations in horizontal spacing and location of slab tendons are permitted when required to avoid openings and inserts.

H. Installation of Anchorage Devices:

1. Place anchorage devices at locations shown on approved installation drawings.
2. Do not switch fixed and stressing-end anchorage locations unless authorized in writing by Architect.
3. Attach pocket formers, intermediate anchorage devices, and stressing-end anchorage devices securely to bulkhead forms. Install stressing-end and intermediate anchorage devices perpendicular to tendon axis.
4. Install tendons straight, without vertical or horizontal curvature, for a minimum of 12 inches behind stressing-end and intermediate anchorages.
5. Embed intermediate anchorage devices at construction joints in first concrete placed at joint.
6. Minimum splice length in reinforcing bars at anchorages is 24 inches. Stagger splices a minimum of 60 inches.
7. Place fixed-end anchorage devices in formwork at locations shown on installation drawings. Support anchorages firmly to avoid movement during concrete placement.
8. Remove loose caps on fixed-end anchorages, refill with post-tensioning coating, and re-attach caps to achieve a watertight enclosure.

I. Maintain minimum concrete cover as follows:

1. From Exterior Edge of Concrete to Wedge Cavity: 1-1/2 inches.
2. From Exterior Edge of Concrete to Strand Tail: 3/4 inch.
3. From Exterior Edge of Concrete to Wedge-Cavity Cap: 1 inch.
4. Top, Bottom, and Edge Cover for Anchorage Devices: 3/4 inch.

J. Maintain minimum clearance of 6 inches between tendons and openings.

K. Where post installed anchors or drilling will be required, prior to concrete placement, mark tendon locations. Verify and receive approval from architect before using spray paint on formwork method.

L. Do not install sleeves within 36 inches of anchorages after tendon layout has been inspected unless authorized in writing by Architect/Structural Engineer of Record.

M. Do not install conduit, pipe, or embeds requiring movement of tendons after tendon layout has been inspected unless authorized in writing by Architect/Structural Engineer of Record.

N. Do not use couplers unless location has been approved by Architect/Structural Engineer of Record.

3.4 SHEATHING INSPECTION AND REPAIR

A. Inspect sheathing for damage after installing tendons. Repair damaged areas by restoring post-tensioning coating and repairing or replacing tendon sheathing.

1. Ensure that sheathing is watertight and there are no air voids.
2. Follow tape repair procedures in PTI's "Field Procedures Manual for Unbonded Single Strand Tendons.

B. Maximum length of exposed strand behind anchorages is as follows:

1. Fixed End: 12 inches.
2. Intermediate and Stressing End: 0.5 inches.
    a. Cover exposed strand by splicing on and taping additional sheathing to prevent contact with concrete.

C. Immediately remove and replace tendons that have damaged strand.

3.5 CONCRETE PLACEMENT

A. Do not place concrete until placement of tendons and nonprestressed steel reinforcement has been inspected by special inspector.

B. Provide Architect/structural Engineer of Record and special inspector a minimum of 48 hours' notice before concrete placement.

C. Place concrete as specified in Division 03 Section 03 30 00. Ensure compaction of concrete around anchorages.

D. Ensure that position of tendon and nonprestressed steel reinforcement does not change during concrete placement. Reposition tendons and nonprestressed steel reinforcement moved during concrete placement.

E. Ensure that method of concrete placement does not damage tendon sheathing. Do not support pump lines, chutes, or other concrete placing equipment on tendons.

3.6 TENDON STRESSING

A. Calibrate stressing jacks and gages at start of job and at least every six months thereafter. Keep copies of calibration certificates for each jack-and-gage pair on Project site and available for inspection. Exercise care in handling stressing equipment to ensure that proper calibration is maintained.

B. Stress tendons only under supervision of qualified post-tensioning superintendent.

C. Do not begin stressing operations until concrete strength has reached 3000 psi as indicated by compression tests of field-cured cylinders.

D. Complete stressing within 72 hours of concrete placement.

E. If concrete has not reached required strength, obtain Architect/Structural Engineer of Record approval to partially stress tendons and delay final stressing until concrete has reached required strength.

F. If detensioning and restressing of tendon is required, discard wedges used in original stressing and provide new wedges.

G. Mark and measure elongations according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons." Measure elongations to closest 1/8 inch.

H. Submit stressing records within one day of completion of stressing. If discrepancies between measured and calculated elongations exceed plus or minus 7 percent, resolve these discrepancies to satisfaction of Architect/Structural Engineer of Record and post tensioning supplier.

I. Prestressing will be considered acceptable if gage pressures shown on stressing record correspond to required stressing force and calculated and measured elongations agree within 7 percent for tendons exceeding 35 feet in length, or 1/4 inch for tendons less than 35 feet in length.

J. If measured elongations deviate from calculated elongations by more than 7 percent for tendons exceeding 35 feet in length, or 1/4 inch for tendons less than 35 feet in length, additional testing, restressing, strengthening, or replacement of affected elements may be required

3.7 TENDON FINISHING

A. Do not cut strand tails or cover anchorages until stressing records have been reviewed and approved by Architect/ Structural Engineer of Record and post tensioning supplier.

B. Cut strand tails as soon as possible after approval of elongations.

C. Cut strand tail between 1/2 and 3/4 inch from wedges. Do not damage tendon or concrete during removal of strand tail. Acceptable methods of cutting strand tail include the following:

1. Oxyacetylene flame.
2. Other methods may be submitted for review and approval.

D. Install caps and sleeves on intermediate anchorages within one day of stressing.

E. Cut strand tails and install caps on stressing-end anchorages within one day of Architect/Structural Engineer of Record acceptance of elongations.

F. Patch stressing pockets within one day of cutting strand tail. Clean inside surface of pocket to remove laitance or post-tensioning coating before installing patch material. Finish patch material flush with adjacent concrete.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports. Cooperate with testing agency to facilitate the execution of its duties:

1. Before concrete placement, special inspector will inspect the following for compliance with post-tensioning installation drawings and the Contract Documents:
    a. Location and number of tendons.
    b. Tendon profiles and cover.
    c. Installation of backup bars, hairpins, and other nonprestressed reinforcement shown on post-tensioning installation drawings.
    d. Installation of pocket formers and anchorage devices.
    e. Repair of damaged sheathing.
    f. Connections between sheathing and anchorage devices.

2. Special inspector will record tendon elongations during stressing.

3. Special inspector will immediately report deviations from the Contract Documents to Architect/Structural Engineer of Record and post tensioning supplier.

3.9 PROTECTION

A. Do not expose tendons to electric ground currents, welding sparks, or temperatures that would degrade component:

B. Protect exposed components within one workday of their exposure during installation.

C. Prevent water from entering tendons during installation and stressing.

D. Provide weather protection to stressing-end anchorages if strand tails are not cut within 10 days of stressing the tendons.

3.10 REPAIRS

A. Submit repair procedure to Architect/Structural Engineer of Record for evaluation and approval:

B. Do not proceed with repairs requiring removal of concrete unless authorized in writing by Architect/Structural Engineer of Record.

END OF SECTION 03 38 16

SECTION 034500 - PRECAST ARCHITECTURAL CONCRETE

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. Architectural precast concrete ridged coping units.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing connection anchors in concrete.

1.3 DEFINITIONS

A. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by Architect.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.

C. Shop Drawings:

1. Detail fabrication and installation of architectural precast concrete units.
2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
4. Indicate details at building corners.
5. Indicate separate face and backup mixture locations and thicknesses.
6. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
7. Include plans and elevations showing unit location and sequence of erection for special conditions.

8. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
9. Indicate relationship of architectural precast concrete units to adjacent materials.
10. Indicate locations, dimensions, and details of thin-brick units, including corner units and special shapes, and joint treatment.
11. Indicate locations, dimensions, and details of stone facings, anchors, and joint widths.
12. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

D. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.

1. When other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.
2. Samples for each thin-brick unit required, showing full range of color and texture expected. Include Sample showing color and texture of joint treatment.

a. Grout Samples for Initial Selection: Color charts consisting of actual sections of grout showing manufacturer's full range of colors.
b. Grout Samples for Verification: Showing color and texture of joint treatment.

E. Delegated-Design Submittal: For architectural precast concrete 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. Show governing panel types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. Material Certificates: For the following items:

1. Cementitious materials.
2. Reinforcing materials.
3. Admixtures.
4. Anchors.

D. Material Test Reports: For aggregates.

E. Preconstruction test reports.

F. Source quality-control test reports.

G. Field quality-control reports.

H. Comply with Florida Building Code Product Approval or Miami-Dade NOA.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance to erect Category A (Architectural Systems) for non-load-bearing members.

B. Installer Qualifications: A precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project in same category as this Project and who can produce an Erectors' Post-Audit Declaration.

C. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Designated as a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units or designated as an APA-certified plant for production of architectural precast concrete products.

D. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

F. Mockups: Before production of architectural precast concrete units, construct full-sized mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockup as indicated on Drawings including aluminum framing, glass, sealants, and architectural precast concrete complete with anchors, connections, flashings, and joint fillers.
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 undamaged at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Anchor Testing: Engage a qualified testing agency to perform preconstruction testing according to ASTM C 1354/C 1354M or ASTM E 488, modified as follows:

1. Furnish test specimens, including stone anchors, that are representative of materials proposed for incorporation into the Work.
2. Anchorage Tests: Test 12 inches square samples for precast coping, orientation of cut, finish, and anchor type proposed for use on Project. Test for shear and tensile strength of anchorage system.

1.9 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other rehandling.

B. Support units during shipment on nonstaining shock-absorbing material.

C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

D. Place stored units so identification marks are clearly visible, and units can be inspected.

E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.

F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Precast Concrete Copings:

1. Basis of Design Manufacturer and Product:
   a. Manufacturer; Modern Precast.
   b. Product: Ridged Coping Units.
2. Finish: Manufacturer's standard sand-made finish.
3. Color: As selected by the Architect from the Manufacturer's full range.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design architectural precast concrete units.

B. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

C. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. Loads: As indicated on the structural drawings.
2. Dead Loads: As indicated on the structural drawings.
3. Live Loads: As indicated on the structural drawings.

4. Wind Loads: As indicated on the structural drawings.
5. Seismic Loads: As indicated on the structural drawings.
6. Design precast concrete units and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements as follows:
    a. Upward and downward movement of 1/2 inch.
7. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 80 deg F (26 deg C).
8. Comply with Florida Building Code Product Approval or Miami-Dade NOA.

2.3 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

B. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.4 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars, with ASTM A 767/A 767M, Class II zinc coating and chromate treatment. Galvanize after fabrication and bending.

D. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, ASTM A 775/A 775M or ASTM A 934/A 934M epoxy coated.

E. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain, flat sheet, Type 1 bendable coating.

F. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.5 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray, unless otherwise indicated.

1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.

B. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
2. Metakaolin: ASTM C 618, Class N.
3. Silica Fume: ASTM C 1240, with optional chemical and physical requirement.
4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
5. Blended Hydraulic Cement: ASTM C 595, [Type IS, portland blast-furnace slag] [Type IP, portland-pozzolan] [Type I (PM), pozzolan-modified portland] [Type I (SM), slag-modified portland] cement.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
    a. Gradation: Uniformly graded.
2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate; to match approved finish sample.

D. Lightweight Aggregates: Except as modified by PCI MNL 117, ASTM C 330/C 330M, with absorption less than 11 percent.

E. Coloring Admixture: ASTM C 979/C 979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.

F. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

H. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
7. Plasticizing Admixture: ASTM C 1017/C 1017M, Type I.
8. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
9. Corrosion Inhibiting Admixture: ASTM C 1582/C 1582M.

2.6 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.

B. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or Type B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.

C. Carbon-Steel Plate: ASTM A 283/A 283M, Grade C.

D. Malleable Iron Castings: ASTM A 47/A 47M, Grade 32510 or Grade 35028.

E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).

F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.

G. Carbon-Steel Structural Tubing: ASTM A 500/A 500M, Grade B or Grade C.

H. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).

I. Deformed-Steel Wire or Bar Anchors: ASTM A 496/A 496M or ASTM A 706/A 706M.

J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A or ASTM F 1554, Grade 36 (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 (ASTM A 563M); and flat, unhardened steel washers, ASTM F 844.

K. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563 (ASTM A 563M); and hardened carbon-steel washers, ASTM F 436 (ASTM F 436M).

2.7 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

2.8 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

1. Use a single design mixture for units with more than one major face or edge exposed.
2. Where only one face of unit is exposed use either a single design mixture or separate mixtures for face and backup.

B. Limit use of fly ash and ground granulated blast-furnace slag to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.

C. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.

D. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.

E. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures or full-depth mixtures, at fabricator's option by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi minimum.
2. Maximum Water-Cementitious Materials Ratio: 0.45.

F. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.

G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

H. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.9 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.

B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Form joints are not permitted on faces exposed to view in the finished work.
2. Edge and Corner Treatment: Uniformly chamfered.

2.10 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.

C. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.

3. Place reinforcing steel and prestressing strands to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

D. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

E. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

F. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

G. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.

H. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.

I. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.

J. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

K. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.11 FABRICATION TOLERANCES

A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

B. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with the following product tolerances:

1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:

    a. 10 feet or under, plus or minus 1/8 inch.
    b. 10 to 20 feet, plus 1/8 inch, minus 3/16 inch.
    c. 20 to 40 feet, plus or minus 1/4 inch.
    d. Each additional 10 feet, plus or minus 1/16 inch.

2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:

    a. 10 feet or under, plus or minus 1/4 inch.
    b. 10 to 20 feet, plus 1/4 inch, minus 3/8 inch.
    c. 20 to 40 feet, plus or minus 3/8 inch.
    d. Each additional 10 feet, plus or minus 1/8 inch.

3. Total Thickness or Flange Thickness: Plus 1/4 inch, minus 1/8 inch.
4. Rib Thickness: Plus or minus 1/8 inch.
5. Rib to Edge of Flange: Plus or minus 1/8 inch.
6. Distance between Ribs: Plus or minus 1/8 inch.
7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch/72 inches or 1/2 inch total, whichever is greater.
8. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch.
9. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch.
10. Dimensions of Haunches: Plus or minus 1/4 inch.
11. Haunch Bearing Surface Deviation from Specified Plane: Plus or minus 1/8 inch.
12. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or minus 1/4 inch.
13. Bowing: Plus or minus L/360, maximum 1 inch.
14. Local Smoothness: 1/4 inch/10 feet.
15. Warping: 1/16 inch/12 inches of distance from nearest adjacent corner.
16. Tipping and Flushness of Plates: Plus or minus 1/4 inch.
17. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch.
18. .

2.12 FINISHES

A. Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved mockups and as follows:

    1. As-Cast Surface Finish: Provide surfaces to match approved sample for acceptable surface, air voids, sand streaks, and honeycomb.

B. Finish exposed top surfaces of architectural precast concrete units to match face-surface finish.

C. Finish exposed back surfaces of architectural precast concrete units with smooth, steel-trowel finish.

D. Finish unexposed surfaces of architectural precast concrete units with as cast finish.

2.13 SOURCE QUALITY CONTROL

A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete, also test and inspect according to PCI TR-6, ASTM C 1610/C 1610M, ASTM C 1611/C 1611M, ASTM C 1621/C 1621M, and ASTM C 1712.

B. Owner will employ an independent testing agency to evaluate architectural precast concrete fabricator's quality-control and testing methods.

1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.

C. Strength of precast concrete units is considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements for concrete strength.

D. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M and ACI 318 (ACI 318M).

1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Architect.
2. Test cores in an air-dry condition.
3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
4. Report test results in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports include the following:

    a. Project identification name and number.
    b. Date when tests were performed.
    c. Name of precast concrete fabricator.
    d. Name of concrete testing agency.
    e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

F. Defective Units: Discard and replace recast architectural concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.

B. Do not install precast concrete units until supporting cast-in-place concrete has attained minimum allowable design compressive strength and supporting steel or other structure is structurally ready to receive loads from precast concrete units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.

B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.

1. Install temporary steel or plastic spacing shims as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch.

C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

1. Do not permit connections to disrupt continuity of roof flashing.

D. Grouting or Dry-Packing Connections and Joints: Grout connections where required or indicated. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

A. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

B. Erect architectural precast concrete units level, plumb, square, and in alignment, without exceeding the following noncumulative erection tolerances:

1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
2. Plan Location from Centerline of Steel: Plus or minus 1/2 inch.
3. Top Elevation from Nominal Top Elevation: As follows:
    a. Exposed Individual Panel: Plus or minus 1/4 inch.
    b. Non-Exposed Individual Panel: Plus or minus 1/2 inch.
    c. Exposed Panel Relative to Adjacent Panel: 1/4 inch.
    d. Non-Exposed Panel Relative to Adjacent Panel: 1/2 inch.
4. Support Elevation from Nominal Support Elevation: As follows:
    a. Maximum Low: 1/2 inch.
    b. Maximum High: 1/4 inch.
5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet: 1 inch.
6. Plumb in Any 10 Feet of Element Height: 1/4 inch.
7. Maximum Jog in Alignment of Matching Edges: 1/4 inch.
8. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch.
9. Maximum Joint Taper: 3/8 inch.
10. Joint Taper in 10 Feet: 1/4 inch.
11. Maximum Jog in Alignment of Matching Faces: 1/4 inch.
12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch.
13. Opening Height between Spandrels: Plus or minus 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections and prepare reports:

1. Erection of loadbearing precast concrete members.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.

D. Testing agency will report test results promptly and in writing to Contractor and Architect.

E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS

A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.6 CLEANING

A. Clean surfaces of precast concrete units exposed to view.

B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034500

SECTION 039500 - CONCRETE SEALER

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 concrete slabs where concrete sealer is indicated.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include manufacturer's printed statement of VOC content.
2. Include C.O.F. data.

B. Samples: Submit five samples of concrete sealer over concrete, 6 by 6 inches sample.

C. Manufacturer Certificates: Signed by manufacturers certifying that concrete sealer comply with requirements.

D. Qualification Data: For Installer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for assemblies.

F. Warranty: Special warranty specified in this Section.

G. Maintenance data.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer with minimum five years documented experience.

1.5 PROJECT CONDITIONS

A. Limitations: Proceed with application only when the following existing substrate conditions permit sealer to be applied according to manufacturers' written instructions and warranty requirements:

1. Ambient temperature is above 40 deg F.

2. Concrete surfaces and mortar have cured for more than 28 days.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree to repair or replace materials that fail to maintain water repellency within specified warranty period.

1. Warranty Period:

a. Provide manufacturer’s standard 5 year labor and 20 year product warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE SEALER

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

1. Acceptable Products:

a. Curecrete Distribution Inc.; Ashford Formula.
b. Euclid Chemical Company (The); Euco Diamond Hard.

2. Flammability: Self-extinguishing.
3. Finish: Non slip finish. Coefficient of friction: 0.6 wet, 0.8 dry.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrate of substances that might interfere with penetration or performance of concrete sealer.

1. Concrete: Remove oil, curing compounds, laitance, and other substances that could prevent adhesion or penetration of concrete sealer.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of concrete sealer and to instruct Applicator on the product and application method to be used.

B. Concrete Sealer: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Do not apply to concrete that is less than number of days' old recommended by sealer manufacturer in writing.

2. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

C. Apply on horizontal surfaces of indicated interior exposed concrete slabs not receiving other finishes.

3.3 CLEANING

A. Immediately clean concrete sealer from adjoining surfaces and surfaces soiled or damaged by concrete sealer application as work progresses. Repair damage caused by concrete sealer application. Comply with manufacturer's written cleaning instructions.

END OF SECTION

SECTION 042200 - CONCRETE UNIT MASONRY

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. Description:

1. This section includes:

a. Concrete masonry units.
b. Mortar and grout.
c. Steel reinforcing bars.
d. Masonry joint reinforcement.
e. Ties and anchors.
f. Miscellaneous masonry accessories.

B. Related Documents and Standards:

1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
2. All Concrete Unit Masonry work on this project shall conform to the Construction Documents, applicable building code including referenced standards, and the requirements of TMS602 “Specifications for Masonry Structures” with clarifications, exemptions, and additions in the Construction Documents.

C. Related Sections:

1. Division 03 Specifications – Concrete Construction
2. Division 07 Specifications – Thermal and Moisture Protection.

1.3 QUALITY ASSURANCE

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.

C. Preinstallation Conference: Conduct conference at Project.

1.4 SUBMITTALS

A. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients. Include:

1. Mix designs and mortar tests performed in accordance with the property specification of ASTM C270.
2. Compressive strength test performed in accordance with ASTM C 1019.

1.5 PROJECT CONDITIONS

A. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings 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.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 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 bullnose units for outside corners unless otherwise indicated.

B. CMUs: ASTM C 90.

1. Density Classification: Normal Weight

2. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
3. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

C. Provide cleanouts at base of each grout pour height that exceeds 5′-4″.

2.3 CONCRETE AND MASONRY LINTELS

A. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 03, and with reinforcing bars indicated.

B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs 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.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615, Grade 60 deformed.

B. Masonry Joint Reinforcement: ASTM A 951

1. Exterior Walls: Hot-dip galvanized carbon steel.
2. Interior Walls: Mill galvanized carbon steel.
3. Wire size: As indicated on the Construction Drawings.

2.6 TIES AND ANCHORS

A. Adjustable Anchors for Connecting to Structural Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Provide units designed for number of bars indicated.

2.8 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, type S.

1. Install all concrete block with natural colored mortar, unless directed otherwise by architect.

B. 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 requirements for dimensions of grout spaces and pour height.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that foundations are within tolerances specified.
2. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units less than 1/2 size at corners or jambs.

C. See construction documents for laying wythes in a running or stacked bond at exposed conditions.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

1. Construct chases and penetrations as masonry units are laid, with required lintels as noted in the construction drawings.

F. Fill space between hollow metal frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install wall with 1 inch joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition.

3.4 MORTAR BEDDING AND JOINTING

A. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

B. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.5 MASONRY JOINT REINFORCEMENT

A. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap joint reinforcement a minimum of 6 inches.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 32 inches o.c. horizontally.

3.7 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in masonry as shown in Construction Documents as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

3.8 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

END OF SECTION 042200

SECTION 050530 – METAL HANGERS AND SUPPORTS

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. Metal framing systems.
2. Spill tray.
3. Fastener systems.

B. See Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 COORDINATION

A. Coordinate installation of anchorages for metal hangers and supports. 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. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For metal hangers and supports and drain pans.

B. Shop Drawings: Include plans, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For hangers and supports, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Unistrut Corp.; Tyco International, Ltd.
2. Ultratech (Grainger).

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design gratings.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.3 METAL FRAMING SYSTEMS

A. Description: Shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Horizontal-Piping Hangers and Supports: 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 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
8. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

C. Building Attachments: 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. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

D. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

1. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

E. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types.

F. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

G. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

H. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.4 SPILL TRAY

A. Description: Pre-fabricated polyethylene spill tray, 48” x 48” x 5-5/8”, with a capacity of 56 gallons; color: black.

1. Basis of Design Manufacturer and Product: Ultratech Spill Tray; Model 09603 as provide by Grainger.

2.5 FASTENERS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Acceptable Manufacturers:

    a. Hilti, Inc.
    b. ITW Ramset/Red Head.
    c. Masterset Fastening Systems, Inc.
    d. MKT Fastening, LLC.
    e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Acceptable Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi 28-day compressive strength.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing hangers and supports to in-place construction. Include threaded fasteners for concrete inserts, through-bolts, lag bolts, and other connectors.

1. Reference Section 033816, Para. 1.6.A for attachments to PT slabs.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing hangers and supports. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete.

D. Fit exposed connections accurately together to form hairline joints.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

C. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

D. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

E. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

F. Fastener System Installation:

1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder- actuated tool manufacturer. Install fasteners according to powder- actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
3. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
4. Equipment Support Installation: Fabricate from welded-structural- steel shapes.
5. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
6. Install lateral bracing with pipe hangers and supports to prevent swaying.
7. 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 (DN 65) 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.
8. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

3.3 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 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and 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. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.5 PAINTING

A. Touch Up: 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.

B. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 050530

SECTION 051200 - STRUCTURAL STEEL

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. Description:

1. This section includes elements of the structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
2. This section does not include Miscellaneous Metal Fabrications.

B. Related Documents and Standards:

1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
2. All Structural Steel work on this project shall conform to the Construction Documents, applicable building code including referenced standards, and the requirements of AISC 360 “Specification for Structural Steel Buildings”, RCSC “Specification for Structural Joints Using High-Strength Bolts”, and AISC303 “Code of Standard Practice for Steel Buildings and Bridges” in coordination with clarifications, exemptions, and additions in the Construction Documents.

C. Related Sections:

1. Division 05 Specifications – Steel Construction.
2. Division 09 Specification – Finishes

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172)..

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

D. Preinstallation Conference: Conduct conference at Project Site.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of the following connections required by the Construction Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering design by a registered design professional licensed in the state in which the project is located, to withstand loads indicated and comply with other information and restrictions indicated.

1. Simple Shear Connections: Connections shall be selected or completed by an experienced steel detailer. Tables in the AISC Steel Construction Manual shall be used.
2. Connections other than Simple Shear Connections: Connections shall be designed by a registered design professional licensed in the state in which the project is located working for the fabricator.
3. Use ASD; data are given at service-load level.
4. Where beam shear is not noted, the connections shall develop the beam shear V = W/2 where W is the total allowable beam uniform load based on laterally supported simple span moments per tables located in the AISC Steel Construction Manual.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Anchor rods.
5. Threaded rods.
6. Forged-steel hardware.
7. Slide bearings.
8. Prefabricated building columns.
9. Shop primer.
10. Galvanized-steel primer.
11. Etching cleaner.
12. Galvanized repair paint.
13. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. Identify members and connections of the seismic-load-resisting system.
6. Indicate locations and dimensions of protected zones.
7. Identify demand-critical welds.
8. Identify members not to be shop primed.
9. Structural Steel Connections:

a. Simple Shear Connections: Include substantiating connection information documenting the shear capacity of a minimum of (3) representative connection types on the project.
b. Connections other than Simple Shear Connections: Include calculations signed and sealed by the registered design professional licensed in the state where the project is located, who is responsible for their preparation. Additionally, the registered design professional in responsible charge of the connection design shall review and confirm in writing that the approval documents properly incorporate the connection designs.

1.6 INFORMATION SUBMITTALS

A. Qualification Data: For qualified Installer and Fabricator.

B. Welding certificates.

C. Material (Mill) test reports for structural steel, including chemical and physical properties.

D. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Steel headed stud anchors (shear connectors/shear studs).
5. Shop primers.

E. Source quality-control reports.

F. Survey of existing conditions.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting fasteners after lubrication.

1.8 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

C. All Structural Steel not receiving fire-proofing shall receive one shop coat of rust-inhibitive primer. All steel with exterior exposure shall be painted with a double coat of rust prohibitive epoxy primer (material and thickness to be specified by Architect) unless noted as galvanized or architecturally exposed structural steel.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Provide Structural Steel materials meeting the standards and grades set forth in the Construction Drawings.

2.2 BOLTS, CONNECTORS, AND ANCHOR RODS

A. Provide Bolts, Connectors, and Anchors of materials meeting the standards and grades set forth in the Construction Drawings.

2.3 SHRINKAGE-RESSISTANT GROUT

A. Provide shrinkage-resistant grout materials meeting the standards and grades set forth in the Construction Drawings.

2.4 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with AISC 303 "Code of Standard Practice for Steel Buildings and Bridges" and to AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermally cut, or punch holes perpendicular to steel surfaces. Do not free-hand thermally cut bolt holes or enlarge holes by burning.

D. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members only as indicated in Structural Construction Drawings.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not free-hand thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.5 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High Strength Bolts" for type of bolt and type of joint specified in the Construction Drawings.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.6 PRIMER PAINT

A. Fabricator’s standard rust-inhibiting grey primer. Do not prime steel that is to receive fire-proofing spray. Provide finish where indicated on Construction Drawings (see Architectural Drawings and Division 09 specifications).

2.7 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to Structural Steel according to ASTM A123.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels, shelf angles, any framing exposed to earth or weather, and other framing as indicated in the Construction Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with Steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep Structural Steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent Structural Steel, connections, bracing, and diaphragms are in place unless otherwise indicated.

3.3 ERECTION

A. Set Structural Steel accurately in locations and to elevations indicated and in accordance with AISC 303 and AISC 360.

B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate where indicated in Structural Construction Drawings.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of Structural Steel within AISC 303 "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Construction Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified in the Construction Drawings.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051200

SECTION 053100 - STEEL DECK

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. Description:

1. This section includes Roof Deck, Noncomposite Form Deck, and Composite Floor Deck.

B. Related Documents and Standards:

1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
2. All Steel Deck work on this project shall conform to the Construction Documents, applicable building code including referenced standards, and the requirements of Steel Deck Institute's (SDI) "Standard Specification" and "Code of Standard Practice."

C. Related Sections:

1. Division 05 Specifications – Steel Construction.
2. Division 09 Specification – Finishes

1.3 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

B. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

1.4 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated on Construction Drawings and/or Shop Drawings.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Coordinate additional requirements with Construction Drawing General Notes and plan notes.

2.2 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Coordinate additional requirements with Construction Drawing General Notes and plan notes.

2.3 NONCOMPOSITE FORM DECK

A. Noncomposite Steel Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Coordinate additional requirements with Construction Drawing General Notes and plan notes.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Self-drilling tapping screws that are in compliance with ASTM C1513 and that have been tested in accordance with AISI standards S904 and S905.

C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of same material and finish as deck; of profile indicated or required for application.

D. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.

E. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

F. Flat Sump Plate: Single-piece steel sheet of same material and finish as deck. For drains, cut holes in the field.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Install deck with corrugations running perpendicular to supports. Deck sheet shall be supported by a minimum of four supports (three span condition).

3.3 ROOF-DECK INSTALLATION

A. Miscellaneous Roof-Deck Accessories: Install roof sump pans, sump plates, ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

3.4 FLOOR-DECK INSTALLATION

A. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

B. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED STEEL 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. Load-bearing wall framing
2. Exterior non-load-bearing wall framing
3. Floor joist framing
4. Roof rafter framing
5. Ceiling joist framing.

B. Related Documents and Standards:

1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
2. All Cold-Formed Steel Framing work on this project shall confirm to the Construction Documents, applicable building code including referenced standards, and the requirements of AISI S100 “North American Specification for the Design of Cold-formed Steel Structural Members”, AISI S240 “North American Standard for Cold-formed Steel Structural Framing”, and AISI S202 “Code of Standard Practice for Cold-formed Steel Structural Framing” in coordination with clarifications, exemptions, and additions in the Construction Documents.

C. Related Sections:

1. Division 05 Specifications – Steel Construction.

1.3 QUALITY ASSURANCE

A. Framing members shall be manufactured and supplied by one manufacturer and be of the type and size as indicated on Construction Drawings and/or Shop Drawings.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

C. Welding: Qualify procedures and personnel according to AWS D1.1, “Structural Welding Code–Steel,” and AWS D1.3, “Structural Welding Code–Sheet Steel.”

D. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory indicated.

B. Shop Drawings: Submit Shop Drawings showing fabrication and erection procedures. Shop Drawing (if indicated as a requirement by this specification) shall bear the seal of a registered design professional licensed in the state in which the project is located.

1. Show locations, sizes, gauges, spacing and types of framing composites, details of connections and framing of windows, doors and punched openings.
2. Indicate all prefabricated framing with individual panels shown for each condition. Indicate member properties, details of connections, all erection and permanent bracing required.
3. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for installation.
4. Shop Drawings shall indicate sequence and method of erection details of all connection of cold-formed steel framing to other elements of the building structure.
5. Indicate shop and field assembly details, including cut and connections.
6. Indicate type and location of welds, bolts, and fastening devices.

C. Delegated-Design Submittal: For work indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the registered design professional responsible for their preparation.

D. Structural design calculations: Indicate compliance with specified design criteria. Calculations shall bear the seal of a registered design professional licensed in the state in which the project is located.

1.5 INFORMATION SUBMITTALS

A. Welding certificates.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed steel framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed steel framing that may be incorporated into the Work include, but are not limited to, the following:

1. Clark Dietrich Building Systems
2. Marino\Ware
3. Cemco Steel

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Employ a qualified design professional, licensed in the state in which the project is located, to perform design and prepare signed and sealed Shop Drawings and Calculations for submittal. Comply with design intent, criteria, and requirements of the Construction Documents.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated in the Construction Documents.

1. Design Loads: As indicated in the Construction Documents.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    a. Exterior Wall Framing: Horizontal deflection of L/600 for brick/stone veneer, L/360 for simulated stone walls or stucco finish and L/240 for EIFS or other flexible finishes.
    b. Floor Joist Framing: Vertical deflection of 1/480 for live loads and l/360 for total loads of the span.
    c. Roof Rafter Framing: Vertical deflection of 1/360 f the horizontally projected span.
    d. Ceiling Joist Framing: Vertical deflection of 1/240 of the span.
3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as indicated in the Construction Documents.
4. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. In addition to design loads all cold-formed members shall be sized for the connection requirements of the cladding and/or framing which attaches to them, including but not limited to sheathing, paneling, doors, windows, louvers, minor canopies, and sun shades.

D. Existing Conditions: Inspect structure for compliance with specified erection tolerances.

E. Design and coordinate installation and location of anchors and inserts with structural system to which cold-formed steel framing is attached.

2.3 MATERIALS

A. Steel Sheet: ASTM A1003, Structural Grade, Type H, minimum 20 gauge, metallic coated, of grade and coating designation as follows:

1. Grade:
   a. ST33H for 33 mil and 43 mil
   b. ST50H for 54 mil, 68 mil, and 97 mil
2. Coating:
   a. G90.

B. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: Not less than coating of connected element.

2.4 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1-3/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated or as required by design, unpunched, with stiffened flanges.

2.5 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer’s standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1-3/8 inches.

B. Steel Track: Manufacturer’s standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.

C. Steel Box or Back-to-Back Headers: Manufacturer’s standard C-shapes and tracks used to form header beams, of web depths indicated or as required by design, unpunched, with stiffened flanges.

D. Vertical Deflection Clips: Manufacturer’s standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

E. Single Deflection Track: Manufacturer’s single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure.

F. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure.
2. Inner Track: Of web depth indicated.

G. Drift Clips: Manufacturer’s standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.6 FLOOR JOIST FRAMING

A. Steel Joists: Manufacturer's standard C-shaped steel joists, unpunched and without splices.

2.7 ROOF-RAFTER FRAMING

A. Steel Rafters: Manufacturer's standard C-shaped steel joists, unpunched and without splices.

2.8 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel joists, unpunched and without splices.

2.9 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.

10. Hole reinforcing plates.
11. Backer plates.

2.10 ANCHORS, CLIPS, AND FASTENERS

A. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

B. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

C. Welding Electrodes: Comply with AWS standards.

2.11 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true-to-line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
4. Fasten other materials to cold-formed steel framing by welding, bolting, or screw fastening, according to Shop Drawings and manufacturer’s requirements.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true-to-line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/4 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances in AISI S202 and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S202, and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed steel framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true-to-line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Handling and lifting of prefabricated panels or assemblies shall be done in a manner as to not cause distortion or damage in any member, or damage to any connection.

H. Loads placed on panels or assemblies during erection shall not exceed design loads.

I. Do not bridge building expansion and control joints with cold-formed steel framing. Independently frame both sides of joints.

J. If required, install insulation, specified in Division 07, in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

K. Erection Tolerances: Install cold-formed steel framing level, plumb, and true-to-line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/4 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 INSTALLATION OF LOAD-BEARING WALL FRAMING

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacing as follows:

1. Anchor Spacing: As required by design, but not to exceed 24 inches max, and within 3 inches of ends.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: As indicated or as required by design.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated or required by design.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
2. Install runner tracks, jack studs, and cripple studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically at 48 inches. Decrease spacing as required by design. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated or as required by design.

1. Anchor Spacing: As required by design, but not to exceed 24 inches max, and within 3 inches of ends.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/4 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated or as required by design.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.

4. In high seismic areas connect drift clips to cold formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Decrease spacing as required by design. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track, or install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

1. Install solid blocking at 96-inch centers.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.6 INSTALLATION OF JOIST FRAMING

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with required end bearing.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches from abutting walls, and as follows:

1. Joist Spacing: as indicated or as required by design.

D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals as indicated or as required by design. Fasten bridging at each joist intersection as follows:

1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 054400 - PRE-ENGINEERED COLD-FORMED STEEL TRUSSES

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. Description:

1. This section includes Pre-Engineered Cold-Formed Steel Trusses consisting of welded, screwed or bolted connected members which are fabricated, cut and assembled prior to delivery or at the job site. Work may be referred to on the Construction Documents as Pre-Engineered Cold-Formed Steel Trusses.
2. Types of prefabricated trusses include:

a. Gable-shaped trusses.
b. Monopitch trusses.
c. Irregular shaped trusses.

B. Related Documents and Standards:

1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
2. All Cold-Formed Steel Framing work on this project shall confirm to the Construction Documents, applicable building code including referenced standards, and where required shall be designed in accord with AISI “Cold Formed Steel Design Manual”.

C. Related Sections:

1. Division 05 Specifications – Steel Construction.

1.3 QUALITY ASSURANCE

A. Framing members shall be manufactured and supplied by one manufacturer and be of the type and size as indicated on drawings and/or shop drawings.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

C. Welding: Qualify procedures and personnel according to AWS D1.1, “Structural Welding Code–Steel,” and AWS D1.3, “Structural Welding Code–Sheet Steel.”

D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing – General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."

E. Trusses shall be designed, fabricated, and erected by a firm which has a record including a minimum of five years of successfully fabricated trussed assemblies similar to scope required and which practices a quality control program which includes inspection by an independent inspection and testing agency acceptable to Architect and authorities having jurisdiction

F. Preinstallation Conference: Conduct conference at Project site.

1.4 SUBMITTALS

A. Product Data: For each type of truss product and components and accessories indicated.

B. Shop Drawings: Submit shop drawings showing fabrication and erection procedures. Shop drawings shall bear the seal of a registered design professional licensed in the state in which the project is located.

1. Show locations, sizes, gage, and dimensions of members to be used including pitch, span, camber configuration and spacing for each type or configuration of truss required. Show all bearing and anchorage details. Specify and detail all supplemental strapping, bracing clips and other accessories required for proper installation. Shop drawings shall include all placement sequences and instructions.
2. Shop drawings shall indicate sequence and method of erection details of all connection of trusses to other elements of the building structure.

C. Delegated-Design Submittal: For work indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the registered design professional responsible for their preparation.

D. Welding certificates.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle and store truss materials and accessories in accordance with manufacturer's instructions to avoid damage from bending, overturning or other cause for which truss is not designed to resist or endure. Storage shall be off-ground in a dry ventilated space or protect with waterproof coverings.

B. Time fabrication and erection of trusses to avoid extended on-site storage and to avoid delaying work of other trades whose work must follow erection of trusses.

1.6 PERFORMANCE REQUIREMENTS

A. Delegated Design: Employ qualified design professional, licensed in the state in which the project is located, to perform design and prepare signed and sealed Shop Drawings and Calculations for submittal. Comply with design intent, criteria, and requirements of the Construction Documents.

B. Structural Performance: Provide trusses capable of withstanding design loads within limits and under conditions indicated in the Construction Documents.

1. Deflection Limits: Design trusses to withstand design loads without deflections greater than the following:

a. Scissor Roof Trusses: Horizontal deflection of **1/360** of the horizontally projected span.
b. Roof Trusses: Vertical deflection of **1/360** of the span.

C. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing – General Provisions."

1. Roof Trusses: Design according to AISI's "Standard for Cold-Formed Steel Framing - Truss Design.

D. In addition to design loads all cold formed members shall be sized for the connection requirements of the sheathing and/or framing which attaches to them, including but not limited to sheathing, paneling, and suspended equipment.

E. Existing conditions: Inspect structure for compliance with specified erection tolerances.

F. Design and coordinate installation and location of anchors and inserts with structural system to which trusses are attached.

PART 2 - PRODUCTS

2.1 FRAMING COMPONENT MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed steel framing components that may be incorporated into the Work include, but are not limited to, the following:

1. All-Span, Inc
2. Alpine TrusSteel
3. Clark Dietrich Building Systems
4. Cemco Steel
5. Marino\Ware

2.2 MATERIALS

A. Galvanized steel meeting ASTM A1003, designation G60, minimum 20 gauge, and minimum 16 gauge for members being welded to structure. Connector plates and connection anchors shall be G90 minimum.

2.3 ROOF TRUSSES

A. Roof Truss Members: Manufacturer's standard-shape steel sections.

2.4 FRAMING ACCESSORIES

A. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Bracing, bridging, and solid blocking.
2. Web stiffeners.
3. Anchor clips.
4. End clips.
5. Gusset plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 4 times design load.

B. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

C. Welding Electrodes: Comply with AWS standards.

2.6 FABRICATION

A. Fabricate trusses and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this section.

1. Fabricate truss assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten truss component members by welding or screws.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

4. Provide all angles, clips, and other miscellaneous pieces necessary to attach trusses to building structure or to attach accessories to trusses.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Pre-engineered cold-formed steel trussed frames shall be fabricated either on or off site prior to erection.

3.3 TRUSS INSTALLATION

A. Install, bridge, and brace trusses according to Shop Drawings and requirements in this Section.

B. Truss Spacing: as indicated or as required by design.

C. Do not alter, cut, or remove framing members or connections of trusses.

D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacing indicated.

E. Erect trusses without damaging framing members or connections.

F. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to LGSEA's Technical Note 551e, "Design Guide for Permanent Bracing of Cold-Formed Steel Trusses."

3.4 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed trusses with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054400

SECTION 055000 – METAL FABRICATIONS

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. Section includes:

1. Steel framing and supports for countertops.
2. Steel framing and supports for mechanical and electrical equipment.
3. Shelf angles.
4. Metal ladders.
5. Metal bollards.
6. Pipe and downspout guard.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. 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.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufactured metal ladders.
2. Metal bars for decorative element.
3. Fasteners.
4. Shop primers.
5. Shrinkage-resisting grout.
6. Metal bollards.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer.

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. 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 D1.6, "Structural Welding Code - Stainless Steel."

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 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 and steel weld plates and angles for casting into concrete. 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.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications 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, rolled trade names, or roughness.

2.2 METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

C. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.

E. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.

F. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

G. Rolled-Stainless Steel Floor Plate: ASTM A793.

H. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallically bonded to steel.

I. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

J. Slotted Channel Furring: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches unless otherwise indicated.
2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B 0.0677-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.

K. Aluminum Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 6061-T6.

L. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.

M. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

N. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.3 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers, A325 with hex nuts for miscellaneous connections.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, (ASTM A563M, Class 10S3) 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 (ASTM F738M); with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy Group 1 (A1).

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); 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. Lag Bolts: ASME B18.2.1.

G. Wood Screws: Flat head, carbon steel, ASME B18.6.1.

H. Plain Washers: Round, carbon steel, ASME B18.22.1.

I. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.

J. 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 E 488, conducted by a qualified independent testing agency.

K. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

L. Post-Installed Anchors: Torque-controlled expansion anchors.

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 and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

M. 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 B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and/or Section 099123 "Interior Painting."

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

E. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

F. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

G. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

I. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

J. Concrete: Comply with requirements in Section 033000 "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. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. 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.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Remove sharp or rough areas on exposed traffic surfaces.

I. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.

2.6 LOOSE STEEL LINTELS

A. Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports indicated and as necessary to complete the Work.

B. Fabricate units from structural-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. Where wood nailers are attached to girders with bolts or lag screws, drill holes at 24 inches o.c.

D. Galvanize miscellaneous framing and supports where indicated.

2.8 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize and prime shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with zinc-rich primer.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.9 METAL LADDERS

A. General:

1. For elevator pit and roof ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:

1. Space siderails 16 inches apart unless otherwise indicated.
2. Siderails: Continuous 3/8-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-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. Support each ladder at top and bottom and not more than 60 inches with welded or bolted steel brackets.
7. Galvanize and prime exterior ladders, including brackets.
8. Prime ladders, including brackets and fasteners, with zinc-rich primer.

C. Aluminum Ladders:

1. Space siderails 16 inches apart unless otherwise indicated.
2. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
3. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
4. Fit rungs in centerline of siderails; fasten by welding or with stainless steel fasteners or brackets and aluminum rivets.
5. Provide platforms as indicated fabricated from pressure-locked aluminum bar grating oe extruded-aluminum plank grating, supported by extruded-aluminum framing. Limit openings in gratings to no more than 3/4 inch in least dimension.
6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted aluminum brackets.
7. Provide minimum 72-inch high, hinged security door with padlock hasp at foot of ladder to prevent unauthorized ladder use.

2.10 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

1. Cap bollards with 1/4-inch-thick steel plate.

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 zinc-rich primer.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.12 GENERAL FINISH REQUIREMENTS

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.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, “Commercial Blast Cleaning”.
2. Interiors (SSPC Zone 1A): SSPC-SP 3, “Power Tool Cleaning”.

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, “Paint Application Specification No. 1,” for shop painting.

2.14 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

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 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 will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

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, if any.

3.3 INSTALLING METAL BOLLARDS

A. Fill metal-capped bollards with concrete and allow concrete to cure seven days before installing.

B. Anchor bollards to existing construction with expansion anchors. Provide for 3/4-inch bolts at each bollard unless otherwise indicated. Embed anchor bolts at least 4 inches in concrete.

C. Fill bollards solidly with concrete, mounding top surface to shed water.

3.4 REPAIRS

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 055213 - 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. Description:

1. This section includes materials, fabrication, and installation of steel handrails and railings which are not specified elsewhere.

B. Related Documents and Standards:

1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
2. All Pipe and Tube Railing work on this project shall confirm to the Construction Documents and applicable building code including referenced standards.

C. Related Sections:

1. Division 05 Specifications – Steel Construction.
2. Division 09 Specification – Finishes

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

C. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

D. 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.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a registered design professional licensed in the state in which the project is located, using performance requirements and design criteria indicated.

B. Structural Performance: Railings 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: 50 lb/ft applied in any direction.
b. Concentrated Load: 200 lb applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Intermediate rails, infill of guards, and panel fillers:

a. Concentrated Load: 50 lb 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 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.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the registered design professional licensed in the state in which the project is located responsible for their preparation.

PART 2 - PRODUCTS

2.1 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.

2.2 FASTENERS

A. General: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 5 for zinc coating.

2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153 or ASTM F 2329 for zinc coating.

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. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

2.3 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. Assemble railings in the shop 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 will be exposed to weather in a manner to exclude 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 either welded or nonwelded 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. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Form changes in direction as follows:

1. As detailed.

K. Bend members in jigs to produce uniform curvature for each 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 railing posts set in concrete, provide sleeves of same material as posts with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.4 FINISHES, GENERAL

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. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.5 STEEL AND IRON FINISHES

A. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

C. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

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 have been 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 have been 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. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. 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. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. 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.

C. 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. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than outside diameter 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.

1. Coordinate with Structural Engineer of Record before core-drilling into any installed concrete.

3.5 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. 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 wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

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 055213

SECTION 057300 - DECORATIVE METAL 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. Ornamental Aluminum Railings and Gates.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: Include for each product to be used:

1. Manufacturer's data sheets on each product to be used.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.
5. Available colors, styles, patterns, and textures.

B. Shop Drawings: Submit shop drawings for fabrication and installation of metal railings. Include plans, elevations and detail sections. Indicate materials, methods, finishes and types of joinery, fasteners, anchorages and accessory items.

C. Load Tests: Submit test results from ASTM E 935 conducted on the manufacturer’s supplied system indicating compliance with required structural loading.

D. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.

E. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Welded connections.
4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

F. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

B. Qualification Data: For qualified professional engineer.

C. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

D. Welding certificates.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

F. Preconstruction test reports.

G. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 CLOSEOUT SUBMITTALS

A. Provide manufacturer’s maintenance instructions that include recommendations for periodic cleaning and maintenance of all components.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 10 years documented experience producing systems specified in this Section.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.9 FIELD 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.

B. Field Measurements: Take measurements of actual dimensions where necessary for fit without gaps. Indicate measurements on shop drawings.

1.10 WARRANTY

A. Provide manufacturer's standard 10 year warranty for each product indicated.

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. Aluminum Decorative Railings:
   a. Manufacturer: Superior Aluminum Products.
      1) Product: Series 9S Seamless Aluminum Railing – Open Double Top Rail.

2.2 PERFORMANCE REQUIREMENTS

A. Comply with requirements of building authorities having jurisdiction in Project location and the following:

1. Handrail Standard: ANSI A1264.1.
2. Occupational Safety and Health Administration - 29 CFR 1910.23 - Guarding floor and wall openings.

B. Structural Performance: Engineer, fabricate, and install handrails, guardrails, and railing systems to withstand, when tested per ASTM E 935, loadings required by applicable building and safety codes but not less than the following:

1. Design Loads: Design to the following requirements. Concentrated and uniform loading need not be applied simultaneously.
2. Uniform load: 50 pounds per foot applied at the top in any direction.
3. Concentrated load: 200 pounds applied at the top in any direction.

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: Same metal and finish as supported rails unless otherwise indicated.

2.4 ORNAMENTAL ALUMINUM RAILINGS

A. Guard Rail Series 9S Seamless Aluminum Railing: Top railings run continuously on top of posts. Posts shall contain machined tops for top rail to set in and machined pockets for center and bottom railing. Brackets shall not be used to attach railing to posts on level applications. Swivel brackets shall be used to attach center and bottom railings to posts on vertically angled applications. Railing transitions to corners or ramps shall contain no interruptions to the top rail. Pickets shall be 3/4 inch square on 4-1/2 inch maximum centers and run between the top and bottom rail. Picket fasteners are concealed by a screw cover in matching finish.

1. Single top and bottom rail, two-line railing system:
    a. Top Rail Size: Model 901; 2-1/2 inch.
    b. Bottom Rail Size: Model 903; 1-5/8 inch.
    c. Vertical Rail Size:
        1) 3/4 inch by 3/4 inch square.
2. Square Posts: 2 inch.
3. Height: As indicated on the drawings.
4. Design: As indicated on the drawings.
5. Base: Size to fit the posts specified.
    a. As indicated on the Drawings.

B. Hand Rails: Series 5H Mounted Hand Rail.

1. Pipe: 1-1/2 inch Schedule 40 pipe with 1.9 inch outside diameter.
2. Handrail to run continuously throughout the whole length of handrail system.
3. Mount to wall, railing, or other structure by utilizing mounting plates.
4. No components shall be fastened via welding.
5. Handrail will be installed at a height of 34 – 38 inches above ramp surface.
6. Clearance of a minimum 1 ½" shall exist between the wall or post surface and the handrail.
7. Top and bottoms of handrail sections that stop at a landing, the handrail shall extend 12 in horizontally beyond the top riser and 12 in. horizontally beyond the bottom tread.
8. Handrail shall be continuous, without interruption by newel posts or other obstructions.
9. Handrails shall return to a wall, guard or walking surface.

2.5 RAILING MATERIALS

A. Rail, Post and Pickets: Aluminum extrusions; alloy and temper 6063-T4 or 6063-T6 or 6005-T61 for rail and posts, and 6063-T5 for square pickets.

1. Tube: ASTM B 211.

B. Sleeved Base Flanges, Anchors, and Railing Accessories: ASTM B 247.

1. Bases cast from manufacturer's standard A-356-T6, 535, or 713 aluminum alloys or solid extruded 6063 aluminum alloy stock.
2. Base flanges and railing accessories cast from manufacturer's standard 319, A-356, A-356-T6, 535, or 713 aluminum alloys.
3. Anchorages: Provide concrete anchorage for fastening and complying with applicable Federal standards. All fasteners used in the system shall be aluminum or stainless steel.

C. Fasteners: Provide concrete anchorage for fastening and complying with applicable Federal standards. All fasteners used in the system shall be aluminum or stainless steel.

D. Grout: Non-shrink Portland cement-based hydraulic grout, mixed and applied in accordance with manufacturer's instructions; gypsum-based material is not acceptable. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and recommended by manufacturer for exterior use.

2.6 FINISH

A. Standard Architectural Coating (AAMA 2603):

1. Color: As selected by the Architect from the Manufacturer’s full range.

B. Satin Anodized Finish:

1. 15 Minute: Architectural Clear Anodic Coating, AA-M12-C22-A21.

2.7 FABRICATION

A. Tolerances: Verify dimensions on site prior to shop fabrication for proper connection to building structure or substrate.

B. Components or railing sections shall be fabricated to exact measurements specified through Drawings and field dimensions.

C. Railing sections shall be fabricated to exact measurements specified through Drawings and field dimensions.

D. Railings angled horizontally, machine to proper angle into the post.

E. Fabricate railing system to meet step railing requirements by providing a rectangular hole in bottom rail.

F. Fabricate railing system to meet step railing requirements; riser and tread dimensions of the steps.

G. Posts grouted in concrete to have one nominal 1/4 inch (6.0 mm) nominal diameter weep hole, 1/2 inch nominal above post collar, in the plane of the rail.

H. Provide components required for anchorage of framing. Fabricate anchors and related components of material and finish as required, or as specifically noted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared. Fully review the supporting structure and substrate to verify a structurally sound base for anchoring railing system.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Coordinate railing installation with installation of waterproof membrane or coating.

C. Ensure that adjacent surfaces, structures, and finishes are protected from damage by construction activities of this section.

D. Use wood blocks and padding to prevent damage to railing members and fittings during erection.

E. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION, GENERAL

A. Install in accordance with manufacturer's instructions.

B. Keep perimeter lines straight, plumb, and level.

C. Provide grounds, clips, backing materials, adhesives, brackets, anchors, and accessories necessary for a complete installation.

D. Expansion Bolt Mounting: Anchor through base plates to concrete substrate.

E. Sleeve Mounting:

1. Arrange for casting of sleeves or core drill concrete to provide holes for railing uprights.
2. After setting, fill holes with hydraulic grout; brace members until grout is cured.

F. Connect railing components in accordance with manufacturer’s instructions applicable to the specified system.

G. Tighten all fasteners so that completed railing is rigid and free of play at joints and component attachments.

3.4 ERECTION TOLERANCES

A. Install railings plumb and level, securely fastened, with vertical members plumb.

1. Maximum variation from plumb: 1/4 inch.
2. Maximum misalignment from true position: 1/4 inch.
3. Maximum misalignment between adjacent separated members: 1/8 inch.

3.5 CLEANING

A. Remove dust or other foreign matter from component surfaces; clean finishes in accordance with AAMA 609 and AAMA 610-02.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 057300

SECTION 061053 - 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. Rooftop equipment bases and support curbs.
2. Wood blocking, cants, and nailers.
3. Wood furring and grounds.
4. Wood sleepers.
5. Plywood backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.
2. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

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. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. 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. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 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.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

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 items indicated on Drawings, and the following:

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, 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 framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

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.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings, and the following:

1. Framing for raised platforms.
2. Concealed blocking.
3. Roof framing and blocking.
4. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
5. Plywood backing panels.

2.4 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. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.
7. Utility shelving.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. Concealed Boards: 19 percent maximum moisture content of [any of the following] [the following] species and grades:

1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods, No. 2 Common grade; NELMA.
5. Northern species, No. 2 Common grade; NLGA.
6. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

D. 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.

E. 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.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 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 A 153/A 153M or of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Screws for Fastening to Metal Framing: ASTM C 1002, 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 or ICC-ES AC308 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.7 METAL FRAMING ANCHORS

A. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

B. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

C. Stainless-Steel Sheet: ASTM A 666, Type 304.

1. Use for exterior locations and where indicated.

2.8 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. 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.

B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

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. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.

4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

F. 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.

G. 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.

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. 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. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

J. 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 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for 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 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal size furring vertically at 24 inches o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal size furring vertically at 16 inches o.c.

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 061053

SECTION 061600 - SHEATHING

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. Wall sheathing.
2. Roof sheathing.
3. Nail base roof sheathing.
4. Composite nail base insulated roof sheathing.
5. Sheathing joint and penetration treatment.

B. Related Sections include the following:

1. Section 061000 "Rough Carpentry" for plywood backing panels.
2. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.3 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 plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Shop Drawings: For air-barrier and water-resistant glass-mat gypsum sheathing assemblies.

1. Show locations and extent of sheathing, accessories, and assemblies specific to Project conditions.
2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. including list of ABAA-certified installers and supervisors employed by Installer, who work on Project and testing and inspecting agency.

B. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.

C. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 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 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistive ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

2.2 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201/D 3201M at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F (76 deg C) shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings, and the following:

1. Roof and wall sheathing within 48 inches of fire walls.
2. Roof sheathing.

2.5 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corporation: GlasRoc.
   b. G-P Gypsum Corporation; Dens-Glass.
   c. United States Gypsum Co.; Securock.
2. Type and Thickness: Type X, 5/8 inch thick.
3. Size: 48 by 96 inches for vertical installation.

2.6 ROOF SHEATHING

A. Plywood Sheathing: Exterior, Structural I sheathing.

1. Span Rating: Not less than 24/0.
2. Nominal Thickness: Not less than 1/2 inch.

B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 24/0.
2. Nominal Thickness: Not less than 3/4 inch.

2.7 NAIL BASE ROOF SHEATHING

A. Backing Panels for Asphalt Shingles: Plywood, DOC PS1, Exposure 1, C-D Plugged, in thickness not less than 3/4 inch nominal thickness.

2.8 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING

A. Plywood-Surfaced, Polyisocyanurate-Foam Sheathing: ASTM C 1289, Type V with DOC PS1, Exposure 1, CDX fire treated plywood on one face.

1. Basis of Design Manufacturer and Product: Hunter Panels; Product: H-Shield NB.
2. Polyisocyanurate-Foam Thickness: 4 inches.
3. Plywood Nominal Thickness: 5/8 inch.

2.9 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Section for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

E. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117. Provide washers or plates if recommended by sheathing manufacturer.

2.10 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

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.

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. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

D. Coordinate wall 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.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with application recommendations, in APA Form No. E30 “Engineered Wood Construction Guide”, for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below and as indicated on Drawings.

1. Nail Base Roof Sheathing:

a. Screw to metal deck.
b. Space panels 1/8 inch apart at edges and ends.

3.3 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. Fasten gypsum sheathing to wood framing with nails or screws.
3. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
4. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. 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 board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board 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 boards.
2. For sheathing under stucco cladding, boards 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.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

SECTION 064113 - WOOD-VENEER-FACED 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. Architectural wood cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets unless concealed within other construction before cabinet installation.
3. Shop finishing of architectural wood cabinets.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

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 panel products, cabinet hardware and accessories and finishing materials and processes.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

C. Samples: For each exposed product and for each color and finish specified, in manufacturer's standard size.

D. Samples for Initial Selection:

1. Shop-applied transparent finishes.

2. Shop-applied opaque finishes.

E. Samples for Verification:

1. Lumber for transparent finish, not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
2. Veneer leaves representative of and selected from flitches to be used for transparent-finished cabinets.
3. Lumber and panel products with shop-applied opaque finish, 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color, with one-half of exposed surface finished.
4. Corner pieces as follows:
   a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
   b. Miter joints for standing trim.
5. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.6 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.

B. Installer Qualifications: Fabricator of products.

C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

A. Environmental Limitations: 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 occupancy levels during the remainder of the construction period.

B. 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, and indicate measurements on Shop Drawings.

C. 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.

1.9 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood-veneer-faced architectural cabinets can be supported and installed as indicated.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087111 "Door Hardware (Descriptive Specification)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOOD CABINETS, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural wood cabinets indicated for construction, finishes, installation, and other requirements.

2.2 WOOD CABINETS FOR TRANSPARENT FINISH

A. Grade: Premium.

B. Type of Construction: Face frame.

C. Cabinet and Door Front Interface Style: Flush overlay.

D. Reveal Dimension: 3/16 inch.

E. Wood for Exposed Surfaces:

1. Species: American walnut.
2. Cut: Plain sliced/plain sawn.
3. Grain Direction: Vertically for doors and fixed panels.
4. Matching of Veneer Leaves: Book match.
5. Veneer Matching within Panel Face: Balance match.

F. Semiexposed Surfaces: Provide surface materials indicated below:

1. Compatible species to that indicated for exposed surfaces, stained to match.

G. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

2.3 WOOD CABINETS FOR OPAQUE FINISH

A. Grade: Custom.

B. Type of Construction: Face frame.

C. Cabinet and Door Interface Style: Flush overlay.

D. Reveal Dimension: 3/16 inch.

E. Species for Exposed Lumber Surfaces: Any closed-grain hardwood.

F. Panel Product for Exposed Surfaces: Medium-density overlay.

G. Semi-exposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
2. Drawer Subfronts, Backs, and Sides: Solid-hardwood lumber, stained to match species indicated for exposed surfaces.
3. Drawer Bottoms: Hardwood plywood.

H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
2. Wood Moisture Content: 5 to 10 percent.
3. Moisture-Resistant Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
    a. Basis-of-Design Product: Subject to compliance with requirements, provide Temple-Inland; Ultrastock-MR.
4. Softwood Plywood: DOC PS 1, medium-density overlay.
5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

B. Marine Grade Plywood Substrate: Provide marine grade plywood countertop substrates at all cabinet units which contain sinks.

C. Composite Wood and Agrifiber 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. MDF: ANSI A208.2, Grade 130.
2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
3. Softwood Plywood: DOC PS 1, medium-density overlay.
4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
5. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10

2.5 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced woodworking standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

C. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

2.6 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)." All cabinet hardware shall be satin nickel finish, unless noted otherwise.

B. Cabinet Hinges:

1. Frameless Concealed Hinges (Adjustable European Type): BHMA A156.9, B01602, 135 degrees of opening, soft-self-closing.

C. Cabinet Hinges for Doors with Glass:

1. Frameless Concealed Hinges (Adjustable European Type): BHMA A156.9, B01612, 135 degrees of opening, self-closing.

D. Back-Mounted Pulls: BHMA A156.9, B02011.

1. Finish: Satin Nickel.

E. Shelf Rests: BHMA A156.9, B04013; metal.

F. Drawer Slides: BHMA A156; B05091 (Grade 1)/B05092 (Grade 2).

1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; full-extension type; self-closing; epoxy-coated steel with polymer rollers.
2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; self-closing; 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 1.
5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.
6. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-150.

G. Door Locks: BHMA A156.11, E07121.

H. Door Silencers: BHMA A156.16, L03011.

I. Tempered Float Glass for Cabinet Doors: ASTM C 1048, Kind FT, Condition A, Type 1 (clear) with exposed edges seamed before tempering, 6mm thick unless otherwise indicated.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.7 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood 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. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.8 FABRICATION

A. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets: 1/16 inch unless otherwise indicated.

B. Complete fabrication, including assembly, finishing, 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. Trial fit assemblies at fabrication 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.

2.9 SHOP FINISHING

A. General: Finish architectural wood cabinets at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural wood cabinets, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of cabinets.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: System - 4, water-based latex acrylic.
3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to cabinets made from closed-grain wood before staining and finishing.
4. Staining: Match approved sample for color.
5. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
6. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

D. Opaque Finish:

1. Grade: Custom.
2. Finish: System - 4, water-based latex acrylic.
3. Color: As selected by Architect from manufacturer's full range.
4. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1. For shop finished items use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly 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.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
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 screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

G. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

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 woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064113

SECTION 064562 – HIGH-PRESSURE DECORATIVE WOOD VENEER LAMINATE 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. High-pressure decorative wood veneer laminate paneling.
2. Wood furring, blocking, shims, and hanging strips for installing high-pressure decorative wood veneer laminate paneling that is not concealed within other construction.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing paneling that is concealed within other construction before paneling installation.

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 paneling can be installed as indicated.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: Submit manufacturer’s product data, including inspection, preparation, fabrication, and installation instructions.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: For high-pressure decorative wood veneer laminate paneling.

1. Include plans, elevations, sections, and attachment details.
2. Show details full size.
3. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or fabricator's standard size.

D. Samples for Initial Selection: For each type of high-pressure decorative wood veneer laminate panel product.

E. Samples for Verification: For each type of exposed laminate, 12 by 12 inches.

1. Provide one Sample applied to core material and with specified edge material applied to one edge.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of product.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

D. Warranty Documentation: Submit manufacturer’s standard warranty.

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.

B. Installer Qualifications: Fabricator 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 paneling 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.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery Requirements: Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:

1. Store and handle materials in accordance with manufacturer’s instructions.
2. Keep materials in manufacturer’s original, unopened containers and packaging until fabrication and installation.
3. Store materials in clean, dry area indoors.
4. Store materials out of direct sunlight.
5. Keep materials from freezing.
6. Store high-pressure decorative wood veneer laminate horizontally, back-to-back, face-to-face, with top sheet turned face-down and caul board placed on top to protect laminate from damage and to reduce chance of warping of top sheets.

7. Store high-pressure decorative wood veneer laminate and substrates for 8 to 10 days before fabrication at 64 degrees F to 72 degrees F (18 degrees C to 22 degrees C) and 50 percent to 60 percent relative humidity.
8. Protect high-pressure decorative wood veneer laminate from light, heat, and moisture.
9. Protect high-pressure decorative wood veneer laminate from contact with floors and exterior walls.
10. Protect corners of high-pressure decorative wood veneer laminate from damage.
11. Protect materials during storage, handling, fabrication, and installation to prevent damage.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.

B. Field Measurements: Where paneling 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 paneling by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.

C. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is 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 MANUFACTURERS

A. Basis of Design Manufacturer and Product:

1. Manufacturer: Lamin-Art, Inc.
2. Product: Veneer-Art High Performance Wood Veneer.

2.2 MATERIALS

A. High-Pressure Decorative Wood Veneer Laminate:

1. Use: Interior applications.
2. Conformance: EN 438-2.
3. Fire Rating, ASTM E 84: Class II.
4. Wood Species Number: As indicated on the Finish Schedule.
5. Wood Species Name: As indicated on the Finish Schedule.
6. Grade: “Veneer-Art” Grade, GP40.
    a. Thickness: 0.040 inches.

7. Finish:

    a. Tru-Grain: LRV 15.0.
    b. Rift-Grain: LRV 3.0.
    c. Weathered-Grain: LRV 5.0.

8. Edge:

    a. Edge Banding: 0.98-inch by 120-inch by 0.027-inch-thick strips of matching edge banding in tru-grain finish and matte finish.
    b. Self-edge.
    c. Solid edge.
    d. Miter-fold edge.
    e. Custom.

B. Substrate (Panel Core): Medium-density fiberboard (MDF), ANSI A208.2 with fire retardant treatment.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces as selected by Architect from laminate manufacturer's full range:

D. Adhesives: Use for bonding high-pressure decorative wood veneer laminate to substrates.

1. Polyvinyl acetate resin (PVA) adhesive.

E. Backing Sheets:

1. Kraft-paper core sheets impregnated with phenolic resin.
2. As necessary to balance assembly and prevent warping.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant Panel Core Material: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

2.4 INSTALLATION 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.

C. Installation Adhesive: Product recommended by panel fabricator for each substrate for secure anchorage.

2.5 FABRICATION

A. Manufacturing Process:

1. Impregnate genuine wood veneers with a protective melamine resin and fuse with phenolic resin-impregnated kraft sheets.
2. Perform lamination under a minimum pressure of 500 psi (3,447 kPa) and at a temperature of approximately 250 degrees F (121 degrees C).
3. Sand pressed laminate to provide uniform thickness and to facilitate adhesive bonding.
4. Contains no added urea-formaldehyde.

B. Inspection:

1. Inspect high-pressure decorative wood veneer laminate surfaces before lamination to ensure they are sound, dry, clean, and free of surface defects.
2. Remove protective peel coat, if applicable, before inspection.
3. Correct defects before lamination.

C. Preparation:

1. Sand and prepare substrates and high-pressure decorative wood veneer laminate as required to provide a smooth and clean surface that is free of dirt, dust, moisture, oil, grease, or other impurities that would interfere with adhesion.
2. Ensure substrates are uniform in thickness and free of defects.

D. Fabrication:

1. Ensure materials, equipment, and workmanship are in accordance with ANSI/NEMA LD 3 and AWI Architectural Woodwork Standards.
2. Bond high-pressure decorative wood veneer laminate to substrates using adhesives in accordance with adhesive manufacturer’s instructions. Do not use pressure greater than 45 psi to avoid starved glue line or telegraphing of substrates.
3. Minimize excessive moisture imbalance between high-pressure decorative wood veneer laminate and substrates by preconditioning materials for 8 to 10 days before fabrication at 64 degrees F to 72 degrees F (18 degrees C to 22 degrees C) and 50 percent to 60 percent relative humidity.
4. Provide air circulation around high-pressure decorative wood veneer laminate and substrates during preconditioning.
5. Machine factory edges before seaming and clean thoroughly with denatured alcohol.
6. Sealing Edges and Seams: Seal exposed edges and seams of high-pressure decorative wood veneer laminate with diluted urethane or clear varnish to prevent moisture penetration/absorption and expansion and contraction which could damage veneer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition paneling to humidity conditions in installation areas.

B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Install paneling 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. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.

1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 inch.

B. Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening unless covered by trim.

3.3 CLEANING

A. Clean high-pressure decorative wood veneer laminate panels promptly after fabrication in accordance with manufacturer’s instructions.

B. Do not use harsh cleaning materials or methods that could damage laminate.

3.4 PROTECTION

A. Protect fabricated high-pressure decorative wood veneer laminate panels from damage.

END OF SECTION 064562

SECTION 067413 - FIBERGLASS REINFORCED GRATINGS

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 glass-fiber-reinforced-plastic gratings and frames and supports for gratings.

1.3 COORDINATION

A. Coordinate installation of anchorages for gratings, grating frames, and supports. 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 glass-fiber-reinforced-plastic gratings.

B. Shop Drawings: Include plans, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For gratings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Subject to compliance with requirements, provide products by the following:

1. Manufacturer: McNichols Co.
2. Product: McNichols Fiberglass Grating Model MS-S-200.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design gratings.

B. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Floors: Uniform load of 250 lbf/sq. ft. or concentrated load of 3000 lbf, whichever produces the greater stress.
2. Limit deflection to L/360 or 1/4 inch, whichever is less.

C. Seismic Performance: Gratings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.5.

2.3 GLASS-FIBER-REINFORCED-PLASTIC GRATINGS

A. Molded Glass-Fiber-Reinforced Gratings: Bar gratings made by placing glass-fiber strands that have been saturated with thermosetting plastic resin in molds in alternating directions to form interlocking bars without voids and with a high resin content.

1. Configuration: 2-inch square mesh, 2 inches thick.
2. Resin: Polyester.
    a. Flame-Spread Index: 25 or less when tested according to ASTM E 84.
3. Color: Manufacturer's standard dark grey.
4. Traffic Surface: Grit surface.

2.4 FABRICATION

A. Shop Assembly: Shop fabricate grating sections to greatest extent possible to minimize field splicing and assembly. 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 material 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 gratings from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

D. Fit exposed connections accurately together to form hairline joints.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

F. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

2.5 GRATING FRAMES AND SUPPORTS

A. Frames and Supports for Glass-Fiber-Reinforced-Plastic Gratings: Fabricate from glass-fiber-reinforced-plastic shapes of sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, use shapes made from same resin as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integral anchors.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. 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 gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.

D. Fit exposed connections accurately together to form hairline joints.

3.2 INSTALLING GLASS-FIBER-REINFORCED-PLASTIC GRATINGS

A. Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard stainless-steel anchor clips and hold-down devices for bolted connections.

END OF SECTION 067413

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

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. Section includes:

1. Modified bituminous sheet waterproofing.
2. Blindside sheet waterproofing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conferences: Conduct conference at Project Site.

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special detail and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS

A. Product Data for each type of product:

1. Include construction details, material descriptions, and tested physical and performance properties for waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

C. Certificate: Certify that products meet or exceed specified requirements.

D. Samples: For the following products:

1. 12-by-12-inch square of waterproofing and flashing sheet.
2. 12-by-12-inch square of drainage panel.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer.

B. Field quality-control reports.

C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Membrane Manufacturer Qualifications: Company specializing in manufacture of products of the type specified and providing technical representatives to visit project site with a minimum of three years' experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years' experience.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to replace waterproofing material that does not comply with requirements or that does not remain watertight during specified warranty period.

1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch in width.
2. Warranty Period: Five years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: 60-mil- thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil- thick, polyethylene film with release liner on adhesive side.

1. Products: Subject to compliance with requirements, provide one of the following products:

a. Grace Construction Products: W.R. Grace & Co.; Bituthene 4000.

2. Physical Properties: As follows, measured per standard test methods referenced:

a. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
f. Hydrostatic-Head Resistance: 150 feet minimum; ASTM D 5385.
g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
h. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.3 BLINDSIDE SHEET WATERPROOFING

A. Blindside Sheet Waterproofing for Horizontal Applications: Uniform, flexible, multilayered-composite sheet membrane that forms a permanent bond with fresh concrete placed against it; complete with accessories and preformed shapes for an unbroken waterproofing assembly; with the following physical properties:

1. Products: Subject to compliance with requirements, provide one of the following products:

a. Grace Construction Products: W.R. Grace & Co.; Preprufe 300R.

2. Physical Properties:

a. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D1970/D1970M.
b. Peel Adhesion to Concrete: 5 lbf/in. minimum; ASTM D903, modified.
c. Lap Adhesion: 5 lbf/in. minimum; ASTM D1876, modified.
d. Hydrostatic-Head Resistance: 230 feet; ASTM D5385, modified.
e. Puncture Resistance: 200 lbf minimum; ASTM E154/E154M.
f. Water Vapor Permeance: 0.1 perm maximum; ASTM E96/E96M, Water Method.
g. Ultimate Elongation: 335 percent minimum; ASTM D412, modified.

B. Blindside Sheet Waterproofing for Vertical Applications: Uniform, flexible, multilayered-composite sheet membrane that forms a permanent bond with fresh concrete placed against it; complete with accessories and preformed shapes for an unbroken waterproofing assembly; with the following physical properties:

1. Products: Subject to compliance with requirements, provide one of the following products:

a. Grace Construction Products: W.R. Grace & Co.; Preprufe 300R.

2. Physical Properties:

a. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D1970/D1970M.
b. Peel Adhesion to Concrete: 5 lbf/in. minimum; ASTM D903, modified.
c. Lap Adhesion: 5 lbf/in. minimum; ASTM D1876, modified.
d. Hydrostatic-Head Resistance: 230 feet; ASTM D5385, modified.
e. Puncture Resistance: 100 lbf minimum; ASTM E154/E154M.
f. Water Vapor Permeance: 0.1 perm maximum; ASTM E96/E96M, Water Method.

3. Ultimate Elongation: 335 percent minimum; ASTM D412, modified

C. Mastic, Adhesives, and Detail Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

2.4 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid primer recommended for substrate by manufacturer of sheet waterproofing material.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.

D. Sheet Strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as sheet waterproofing.

E. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.

F. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.

G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

I. Protection Course: ASTM D6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:

1. Thickness: Nominal 1/8 inch for vertical applications; 1/4 inch elsewhere.
2. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.

J. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C578, Type X, 1/2 inch thick.

2.5 MOLDED-SHEET DRAINAGE PANELS

A. High-Capacity, Molded-Sheet Collector-Panel System: Composite subsurface collector-panel system by same manufacturer as primary molded-sheet drainage panels; consisting of a high-profile, studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing with an apparent opening size not exceeding No. 40 sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate of 9 to 15 gpm per ft. and a horizontal flow rate as indicated on Drawings. Provide system with manufacturer's outlets, connectors, tapes, and other accessories to connect primary molded-sheet drainage panels with piped subdrainage system specified in Section 334600 "Subdrainage."

1. Products: Subject to compliance with requirements, provide the following:

a. Grace, W. R., & Co. - Conn.; Hydroduct 220.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install sheet strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

F. Bridge and cover discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.

1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:

a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
b. At plaza deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET WATERPROOFING APPLICATION

A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

D. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.

3.4 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.5 INSTALLATION OF BLINDSIDE SHEET WATERPROOFING

A. Install blindside sheet waterproofing according to manufacturer's written instructions.

B. Place and secure molded-sheet drainage panels over substrate. Lap edges and ends of geotextile to maintain continuity.

C. Vertical Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation. Mechanically fasten to substrate.

1. Securely fasten top termination of membrane with continuous metal termination bar anchored into substrate and cover with detail tape.

D. Horizontal Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation.

E. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.

F. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.

G. Install sheet waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.

H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape

3.6 PROTECTION AND CLEANING

A. Protect waterproofing 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 071326

SECTION 071413 - HOT FLUID-APPLIED RUBBERIZED ASPHALT 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. Rubberized-asphalt waterproofing membrane, reinforced.
2. Molded-sheet drainage panels.
3. Insulation.
4. Plaza-deck pavers supported on pedestals.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review waterproofing requirements, including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins to adjoining waterproofing, and other termination conditions.

1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

C. Samples: For plaza-deck pavers in each color and texture required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Mockups: Install waterproofing to 100 sq. ft. of deck to demonstrate surface preparation, crack and joint treatment, corner treatment, thickness, texture, and execution quality. Install pavers and paver supports to demonstrate aesthetic effects, and set quality standards for materials and execution.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.

B. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Weather Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, or when temperature is below zero deg F.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace waterproofing and sheet flashings that do not comply with requirements or that fail to remain watertight within specified warranty period.

1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pedestal-mounted pavers on plaza decks.
2. Warranty insulation retains 80 percent of original published thermal value.

3. Warranty pavers do not dish or warp and do not crack, split, or disintegrate in freeze-thaw conditions.
4. Warranty Period: 10 years from date of Substantial Completion.

B. Special Installer's Warranty: Specified form signed by Installer, covering Work of this Section, for warranty period of two years.

1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pedestal-mounted pavers on plaza decks.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain waterproofing materials, sheet flashings, protection course, molded-sheet drainage panels, insulation, pavers, and pedestals from single source from single manufacturer.

2.2 WATERPROOFING MEMBRANE

A. Hot Fluid-Applied, Rubberized-Asphalt Waterproofing Membrane: Single component; 100 percent solids; hot fluid-applied, rubberized asphalt; high viscosity material applied at 215 mils.

1. Products: Subject to compliance with requirements, provide the following:

a. American Hydrotech, Inc.; Monolithic Membrane 6125-EV.

2.3 FLASHING SHEET MATERIALS

A. Elastomeric Flashing Sheet: 50-mil- minimum, uncured sheet neoprene as follows:

1. Tensile Strength: 1400 psi minimum; ASTM D 412, Die C.
2. Elongation: 300 percent minimum; ASTM D 412.
3. Tear Resistance: 125 psi minimum; ASTM D 624, Die C.
4. Brittleness: Does not break at minus 30 deg F; ASTM D 2137.

B. Stainless-Steel Flashing and Counterflashing: ASTM A 240/A 240M, Type 304, dead soft, fully annealed, with smooth surface.

1. Finish: No. 2D (dull, cold rolled).

2.4 AUXILIARY MATERIALS

A. Primer: ASTM D 41, asphaltic primer.

B. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum termination bars; approximately 1 by 1/8 inch thick; with anchors.

C. Sealants and Accessories: Manufacturer's recommended sealants and accessories.

D. Reinforcing Fabric: Manufacturer's recommended, spun-bonded polyester fabric.

E. Protection Course: Manufacturer's standard, 80- to 90-mil- thick, fiberglass-reinforced rubberized asphalt or modified bituminous sheet.

F. Root Barrier: Manufacturer's standard black plastic sheet manufactured from recycled polyethylene or polypropylene plastic; formulated to resist root growth and bacteria.

2.5 MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve, laminated to one side with a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm/ft.

2.6 INSULATION

A. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, Type V, 100-psi minimum compressive resistance, square or shiplap edged.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Dow Chemical Company (The).
    b. Owens Corning.
    c. T. Clear Corporation, a subsidiary of Fin Pan Inc.

2.7 PLAZA-DECK PAVERS

A. Plaza-Deck Pavers: Heavyweight, hydraulically pressed, concrete units, square edged, manufactured for use as plaza-deck pavers; minimum compressive strength 7500 psi, ASTM C 140; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. American Hydrotech, Inc.
    b. Hanover Architectural Products.
    c. Wausau Tile Inc.
    d. Westile Roofing Products.
2. Thickness: 2 inches.
3. Face Size: As indicated.
4. Color: As selected by Architect from manufacturer's full range.

B. Paver Supports: Paver manufacturer's standard SBR rubber, high-density polyethylene, or polyurethane paver support assembly, including adjustable or stackable pedestals, shims, and spacer tabs for joint spacing of 1/8 inch.

1. Concrete Fill: ACI 301, compressive strength of 5000 psi at 28 days, and air content of 6 percent.

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.

1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

D. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate according to ASTM D 4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces according to ASTM D 4258.

E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, and other voids.

3.3 JOINTS, CRACKS, AND TERMINATIONS

A. Prepare and treat substrates to receive waterproofing membrane, including joints and cracks, deck drains, corners, and penetrations according to manufacturer's written instructions.

1. Rout and fill joints and cracks in substrate. Before filling, remove dust and dirt according to ASTM D 4258.
2. Adhere strip of elastomeric sheet to substrate in a layer of hot rubberized asphalt. Extend elastomeric sheet a minimum of 6 inches on each side of moving joints and cracks or joints and cracks exceeding 1/8 inch thick, and beyond deck drains and penetrations. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.
3. Embed strip of reinforcing fabric into a layer of hot rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches on each side of nonmoving joints and cracks not exceeding 1/8 inch thick, and beyond roof drains and penetrations.

a. Apply second layer of hot fluid-applied, rubberized asphalt over reinforcing fabric.

B. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, bridge joints with elastomeric sheet extended a minimum of 6 inches on each side of joints and adhere to substrates in a layer of hot rubberized asphalt. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.

3.4 FLASHING INSTALLATION

A. Install elastomeric sheets at terminations of waterproofing membrane according to manufacturer's written instructions.

B. Prime substrate with asphalt primer.

C. Install elastomeric sheet and adhere to deck and wall substrates in a layer of hot rubberized asphalt.

D. Extend elastomeric sheet up walls or parapets a minimum of 8 inches above plaza-deck pavers and 6 inches onto deck to be waterproofed.

E. Install termination bars and mechanically fasten to top of elastomeric flashing sheet at terminations and perimeter of waterproofing.

3.5 MEMBRANE APPLICATION

A. Apply primer, at manufacturer's recommended rate, over prepared substrate and allow it to dry.

B. Heat and apply rubberized asphalt according to manufacturer's written instructions.

1. Heat rubberized asphalt in an oil- or air-jacketed melter with mechanical agitator specifically designed for heating rubberized asphalt.

C. Start application with manufacturer's authorized representative present.

D. Reinforced Membrane: Apply hot rubberized asphalt to substrates and adjoining surfaces indicated. Spread to a thickness of 90 mils; embed reinforcing fabric, overlapping sheets 2 inches; spread another 125-mil thick layer to provide a uniform, reinforced, seamless membrane 215 mils thick.

E. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.

F. Cover waterproofing with protection course with overlapped joints before membrane is subject to construction or vehicular traffic.

3.6 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate according to manufacturer's written instructions. Use methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.7 INSULATION INSTALLATION

A. Install one or more layers of board insulation to achieve required thickness over waterproofed surfaces. Cut and fit to within 3/4 inch of projections and penetrations.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.8 PLAZA-DECK PAVER INSTALLATION

A. Install concrete pavers according to manufacturer's written instructions.

B. Accurately install adjustable-height paver pedestals and accessories to elevations required. Adjust for final level and slope with shims.

1. Fill paver pedestal with concrete mix, strike smooth with top of pedestal, and cure according to ACI 301.

C. Loosely lay pavers on pedestals, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.

1. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.

D. Install pavers to not vary more than 1/16 inch in elevation between adjacent pavers or more than 1/16 inch from surface plane elevation of individual paver.

E. Limit variation in paving installation to within 1/4 inch in 10 feet of surface plane in any direction; noncumulative.

3.9 FIELD QUALITY CONTROL

A. Engage a full-time site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions; surface preparation; and application of membrane, flashings, protection, and drainage components; furnish daily reports to Architect.

1. Site representative shall measure membrane thickness with pin tester or other suitable device at least once for every 100 sq. ft. and include measurements in reports.

B. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, waterproofing application, protection, and drainage components, and to furnish reports to Architect.

1. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing and protecting waterproofing but before overlaying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water. Testing agency shall observe flood testing.

a. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
b. Flood each area for 24 hours.

c. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.

2. Electric Field Vector Mapping (EFVM): Testing agency shall survey entire waterproofing area for potential leaks using EFVM.

3.10 CLEANING AND PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Protect installed board insulation from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071413

SECTION 071616 - CRYSTALLINE 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 crystalline waterproofing for negative-side application to concrete.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete" for waterstops and finishing concrete walls and slabs to receive waterproofing.
2. Section 079200 "Joint Sealants" for elastomeric and preformed sealants in concrete and concrete unit masonry walls and floors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions and installation instructions for crystalline waterproofing.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Applicator.

B. Product Certificates: For waterproofing, patching, and plugging materials, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for crystalline waterproofing.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying crystalline waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and that employs workers trained and approved by manufacturer.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions.

B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.

C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F or above during work and cure period, and space is well ventilated and kept free of water.

PART 2 - PRODUCTS

2.1 WATERPROOFING MATERIALS

A. Crystalline Waterproofing: Prepackaged, gray-colored proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates into concrete and concrete unit masonry and reacts chemically with the byproducts of cement hydration in the presence of water to develop crystalline growth within substrate capillaries to produce an impervious, dense, waterproof substrate; that has VOC content complying with limits of authorities having jurisdiction; with properties meeting or exceeding the criteria specified below.

1. Products: Subject to compliance with requirements, provide the following:
   a. Xypex Chemical Corporation; Xypex.
2. Water Permeability: Maximum zero for water at 30 feet when tested according to CE CRD-C 48.
3. Compressive Strength: Minimum 4000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.2 ACCESSORY MATERIALS

A. Patching Compound: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended by waterproofing manufacturer for filling and patching tie holes, honeycombs, reveals, and other imperfections; compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.

B. Plugging Compound: Factory-premixed cementitious compound with hydrophobic properties and recommended by waterproofing manufacturer; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead, and horizontal surfaces not exposed to vehicular traffic); compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.

C. Water: Potable.

2.3 MIXES

A. Crystalline Waterproofing: Add prepackaged dry ingredients to water according to manufacturer's written instructions. Mix together with mechanical mixer or by hand to required consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.

B. Proceed with application only after unsatisfactory conditions have been corrected.

C. Notify Architect in writing of active leaks or defects that would affect system performance.

3.2 PREPARATION

A. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.

B. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.

C. Stop active water leaks with plugging compound according to waterproofing manufacturer's written instructions.

D. Repair damaged or unsatisfactory substrate with patching compound according to manufacturer's written instructions.

1. At holes and cracks in substrate, remove loosened chips and cut reveal with sides perpendicular to surface, not tapered, and approximately 1 inch deep. Fill reveal with patching compound flush with surface.

E. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.

1. Clean concrete surfaces according to ASTM D 4258.

a. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.

2. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

3.3 APPLICATION

A. General: Comply with waterproofing manufacturer's written instructions for application and curing.

1. Saturate surface with water for several hours prior to application and maintain damp condition until applying waterproofing. Remove standing water.
2. Apply waterproofing to surfaces indicated on Drawings.
3. Number of Coats: Number required for specified water permeability.
4. Application Method: Brush or spray. Apply to ensure that each coat fills voids and is in full contact with substrate or previous coat.
5. Dampen surface between coats.

B. Final Coat Finish: Brushed or spray Textured.

C. Curing: Moist-cure waterproofing for three days immediately after final coat has set, followed by air drying, unless otherwise recommended in writing by manufacturer.

D. Waterproofing Treatment Extensions: Extend waterproofing treatment as follows:

1. Onto columns integral with treated walls.
2. Onto interior nontreated walls intersecting exterior treated walls, for a distance of 24 inches for cast-in-place concrete and 48 inches for masonry.
3. Onto exterior walls and onto both exterior and interior columns, for a height of 12 inches, where floors, but not walls, are treated.
4. Onto every substrate in areas indicated for treatment, including pits, sumps and similar offsets and features.

3.4 FIELD QUALITY CONTROL

A. Inspection: Engage manufacturer's representative to inspect completed application and provide a written report that application complies with manufacturer's written instructions.

END OF SECTION 071616

SECTION 071800 – TRAFFIC COATINGS

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 pavement markings for the following applications:

1. Pavement markings.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTAL

A. Product Data: For each type of product, including installation instructions.

B. Shop Drawings: For pavement markings:

1. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions.

C. Samples for Initial Selection: For each type of exposed finish.

D. Samples for Verification: For each type of exposed finish prepared on rigid backing.

1. Provide stepped samples on backing large enough to illustrate build-up of pavement markings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each pavement marking signed by manufacturer.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pavement markings to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Membrane Manufacturer Qualifications: Company specializing in manufacture of products of the type specified and providing technical representatives to visit project site with a minimum of three years' experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years' experience.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply pavement markings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply pavement markings 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 pavement markings 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 the substrate.

B. Do not install pavement marking until items that penetrate membrane have been installed.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace pavement marking that fails in material 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.

B. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Material Compatibility: Provide primers; base, intermediate, and top coats; and miscellaneous materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.

B. Source Limitations: As follows:

1. Obtain pavement markings of a single manufacturer.
2. Obtain primary pavement marking materials, including primers, from pavement marking manufacturer. Obtain secondary materials including aggregates, sheet flashings, joint

sealants, and substrate repair materials of type and from source recommended by pavement marking manufacturer.

2.2 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.

1. Color: As indicated.

B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.

1. Color: As indicated.

C. Glass Beads: AASHTO M 247, Type 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of traffic-coating work.

B. Verify that substrates are visibly dry and free of moisture.

1. 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 substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

1. 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.
2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. General: Before applying pavement markings, 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.

B. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.

C. Mask adjoining surfaces not receiving pavement markings to prevent overspray, spillage, leaking, and migration of coatings. Prevent traffic-coating materials from entering deck substrate penetrations and clogging weep holes and drains.

3.3 PAVEMENT MARKINGS

A. Do not apply pavement-marking paint for striping and other markings until layout, colors, and placement have been verified with Architect and pavement marking has cured.

B. Sweep and clean surface to eliminate loose material and dust.

C. Apply pavement-marking paint with mechanical equipment to produce markings of dimensions indicated with uniform straight edges. Apply at manufacturer's recommended rates for a minimum wet-film thickness of 15-mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
2. Broadcast glass beads uniformly into wet pavement-marking paint at a rate of 6 lb/gal.

3.4 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. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Prepare test and inspection reports.

3.5 PROTECTING AND CLEANING

A. Protect pavement markings 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 071800

SECTION 071813 - BALCONY COATINGS

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 traffic coatings for the following applications:

1. Pedestrian traffic.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTAL

A. Product Data: For each type of product, including installation instructions.

B. Shop Drawings: For traffic coatings:

1. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions.

C. Samples for Initial Selection: For each type of exposed finish.

D. Samples for Verification: For each type of exposed finish prepared on rigid backing.

1. Provide stepped samples on backing large enough to illustrate build-up of traffic coatings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each traffic coating signed by manufacturer.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For traffic coatings to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Membrane Manufacturer Qualifications: Company specializing in manufacture of products of the type specified and providing technical representatives to visit project site with a minimum of three years' experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years' experience installing specified system.

C. Mockups: Apply mockups to set quality standards for materials and execution.

1. Build mockup for each traffic coating and substrate to receive traffic coatings.
2. Size: 100 sq. ft. of each substrate to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered in original sealed containers, clearly marked with supplier's name, brand name and type of material.

B. Recommended material storage temperature is 77°F (25°C). Handle products to prevent damage to container. All materials shall be stored in compliance with local fire and safety requirements. Do not store at high temperatures or in direct sunlight.

1.9 FIELD CONDITIONS

A. Only apply to dry surfaces. Do not apply to damp or frosty surfaces. Do not proceed with application of materialsif precipitation is imminent.

B. Ambient temperature should be a minimum 23°F (-5°C). Contact NEOGARD® if applying below 23°F (-5°C). Special precautions are to be taken when ambient and/or substrate temperatures are approaching, at, or above 100°F (38°C) and it may be necessary to limit material application to evening hours for exterior exposed decks.

C. Coordinate coating work with other trades. Applicator shall have sole right of access to the specified area for the time needed to complete the application.

D. Protect plants, vegetation or other surfaces not to be coated against damage or soiling.

E. Keep products away from spark or flame. Do not allow the use of spark-producing equipment during application and until all vapors have dissipated. Post "No Smoking" signs.

F. Maintain work area in a neat and orderly condition, removing empty containers, rags and rubbish daily from the site. All waste PUMA/PMMA liquids shall be catalyzed for proper disposal.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace traffic coating that fails in material or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Material Compatibility: Provide primers; base, intermediate, and top-coats; and miscellaneous materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.

B. Source Limitations: As follows:

1. Obtain traffic coatings of a single manufacturer.
2. Obtain primary traffic coating materials, including primers, from traffic coating manufacturer. Obtain secondary materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of type and from source recommended by traffic coating manufacturer.

2.2 PEDESTRIAN TRAFFIC COATING

A. Traffic Coating: Manufacturer's standard, fluid-applied coating system.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Neogard, NEOGARD® RTS System A Pedestrian System.

B. Pedestrian Traffic Coating Materials:

1. Cleaner: 800 RTS PMMA Cleaning Agent (66ZJB).
2. Filler: 900 RTS PMMA Filler (63ZJB).
3. Initiator: 600 RTS PMMA/PUMA Initiator (95UJB).
4. Primer: 100 RTS Concrete and Metal Primer (256J9).
5. Aggregate:
    a. 7992-U 16/30 mesh silica quartz sand.
    b. 86364 20/40 mesh silica quartz sand (66030).
6. Membrane: 200 RTS Membrane PUMA coating (870J9).
7. Body Coat: 300 RTS Flexible Body Coat PMMA coating (871J9).
8. Topcoat: 400 RTS Topcoat PMMA coating (872J9).
9. Pigment: 700 RTS series pigments (63YJB).

2.3 ACCESSORIES

A. Miscellaneous materials such as cleaning agents, adhesives, reinforcing fabric, backer rod, deck drains, etc., shall be compatible with the specified pedestrian traffic coating system.

2.4 MIXING

A. Comply with manufacturer's instructions for mixing procedures.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of traffic-coating work.

B. Concrete: Verify that the work done under other sections meets the following requirements:

1. That the concrete deck surface is free of ridges and sharp projections. If metal forms or decks are used they should be ventilated to permit adequate drying of concrete.
2. That the concrete was finished by a power or hand steel trowel followed by soft hair broom to obtain lighttexture or “sidewalk” finish.
3. That the concrete was cured for a minimum of 28 days. (Minimum of 3,000 psi compressive strength). Water- cured treatment of concrete is preferred. The use of concrete curing agents, if any, shall be of the sodiumsilicate base only; others require written approval by the manufacturer.
4. That moisture content in the concrete must be less than 6% as measured using a Tramex CME 4 Moisture Meter. Only apply to dry surfaces. Do not apply to damp surfaces.

C. Metal:

1. Metal surface are to be prepared to SSPC- SP5/NACE No 1 Blast Cleaning, white metal finish.

3.2 PREPARATION

A. Cleaning: Surfaces contaminated with oil or grease shall be vigorously scrubbed with a stiff bristle broom and a strong non-sudsing detergent such as NEOGARD® 8500 BioDegradable Cleaner (Hempel 089JB). Thoroughly wash, clean, and dry. Areas where oil or other contaminants penetrate deep into the concrete may require removal by mechanical methods.

B. Shot-Blasting: Required surface preparation method for remedial construction is also the preferred method for new construction. Mechanically prepare surface by shot-blasting to industry standard surface texture (ICRI's CSP3-CSP4) without causing additional surface defects in substrate. Shot-blasting does not remove deep penetrating oils, grease, tar or asphalt stains. Proper cleaning procedures should be followed to ensure proper bonding of the deckcoating.

C. Hydro-Blasting: Alternative if shot-blasting is not practical. Use a minimum of 4,000 psi spray at tip, within 6” of substrate to prepare surface by hydro-blasting to industry standard surface texture (ICRI’s CSP3–CSP4) without causing additional surface defects in deck. Rinse thoroughly to ensure all residue is removed from the surface. Allow deck to completely dry prior to application of deck coating materials.

D. Cracks, Cold Joints and Control Joints:

1. Moving Cracks: Apply 100 PMMA Concrete and Metal Primer and fill with 200 Membrane.
2. Non-Moving Cracks: Apply 100 PMMA Concrete and Metal Primer and fill with 300 Flexible Body Coat.
3. Strike coating flush with adjacent surfaces.

3.3 INSTALLATION

A. Clean tools with NEOGARD® 800 PMMA Cleaning Agent only. Other solvents may contaminate PMMA/PUMA coatings, and cause coating to cure improperly.

B. Add appropriate dosage of NEOGARD® 600 RTS BPO Initiator to all materials and mix thoroughly before applying.

C. System A:

1. Primer: Apply 100 RTS primer at a rate of 90 sf/gal to yield 17 mils to all surfaces. Allow to dry approximately 45 minutes.
2. Membrane: Mix 200 RTS Membrane with 700 RTS series pigment at 0.25 lbs/gallon. Apply at a rate of 26 sf/gal to yield 60 dry mils. Extend base coat over cracks and control joints which have received detail treatment.
3. Flexible Body Coat: Apply 300 RTS Flexible Body Coat at a rate of 90 sf/gal to yield 17 dry mils. Immediately broadcast 20/40 mesh silica quartz aggregate to excess. When dry, remove excess aggregate.
4. Topcoat: Mix 400 RTS Topcoat with 700 RTS series pigment at 0.25 lbs/gallon. Apply at a rate of 64 sf/gal to yield 25 dry mils.

D. System B:

1. Primer: Apply 100 RTS primer at a rate of 90 sf/gal to yield 17 mils to all surfaces. Allow to dry approximately 45 minutes.
2. Flexible Body Coat: Apply 300 Flexible Body Coat mixed with 900 RTS Filler at 10 lbs/gal at a rate of 26 sf/gal to yield 60 dry mils. Immediately broadcast 20/40 mesh silica quartz aggregate to excess. When dry, remove excess aggregate.
3. Topcoat: Mix 400 Topcoat with 700 RTS series pigment at 0.25 lbs/gallon. Apply at a rate of 64 sf/gal to yield 25 dry mils.

3.4 CLEANING

A. Remove debris resulting from completion of coating operation from the project site.

B. Refer to the manufacturer's Maintenance Manual for typical cleaning methods.

3.5 PROTECTION

A. System may be opened to traffic 1 hour after application.

END OF SECTION 071813

SECTION 072100 - THERMAL INSULATION

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. Section includes:

1. Foam-plastic board insulation.
2. Glass-fiber blanket insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. For blown-in or sprayed fiberglass and cellulosic-fiber loose-fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
2. Sign, date, and post the certification in a conspicuous location on Project site.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

C. Research/Evaluation Reports: For foam-plastic insulation from ICC-ES.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify materials with appropriate markings of applicable testing and inspecting agency.

1.6 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.

B. Protect foam plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.7 WARRANTY

A. Provide written warranty that the actual thermal resistance of the extruded polystyrene foam insulation will not vary by more than 10% from its published thermal resistance.

B. Provide the manufacturers standard 50-year thermal limited warranty available on STYROFOAM™ Insulation products 1.5 inches and greater, that for a period of fifty (50) years, commencing with the date of manufacture printed on the unit label or insulation, that the insulation's actual thermal resistance will not vary by more than ten (10) percent from the minimum R-value identified in ASTM C578.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively per ASTM E84:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Dow Chemical Company.
   b. Owens Corning.
2. Type IV, 25 psi.
3. Thickness: As indicated on the drawings.

2.2 CONTINUOUS INSULATION

A. Basis of Design Manufacturer and Product: The Dow Chemical Company; Product STYROFOAM™ Brand CAVITYMATE ™ Ultra Extruded Polystyrene Foam Insulation.

B. Extruded-Polystyrene Board Insulation: ASTM C 578, with maximum flame-spread and smoke developed indexes of 25 and 450, respectively, per ASTM E 84.

1. Rigid closed cell extruded polystyrene foam insulation.
2. Comply with ASTM C 578-95, Type IV, density 1.6 lb/cu. ft. min. compressive resistance 25 psi (ASTM D 1621-94).

3. Thermal resistance: R-values of 6.0 and 5.6 min. per inch °F-ft2-h/Btu2/inch at 40 °F and 75 °F respectively (ASTM C 518-98). STYROFOAM™ CAVITYMATE™ Ultra Air Barrier Wall System.
4. Water absorption: Max. 0.1% by volume (ASTM C 272-91 (96)).

C. Board dimensions: 15-3/4” x 96”.

1. Thickness: As indicated on the drawings.

D. Accessories:

1. Adhesive: type recommended by insulation manufacturer.
2. Insulating Foam Sealant: Dow Chemical GREAT STUFF PRO™ Gaps & Cracks.

2.3 POLYISOCYANURATE FOAM-PLASTIC BOARD

A. Polyisocyanurate Board Foil Faced: ASTM C 1289, foil faced, Type I, Class 1 or 2, for NFPA 285 assemblies.

1. Basis of Design Manufacturer and Product: Atlas EnergyShield Pro Continuous Wall Insulation.
2. Fire Propagation Characteristics: Class A, passes NFPA 285 testing as part of an approved assembly.
3. Location: Where indicated on the drawings under fiber cement applications.

2.4 POLYISOCYANURATE FOAM-PLASTIC BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atlas Roofing Corporation.
2. Carlisle Coatings and Waterproofing Inc.
3. Dow Chemical Company.
4. Firestone Building Products.

B. Polyisocyanurate Board Glass-Fiber-Mat Faced: ASTM C 1289, glass-fiber-mat faced, Type II, Class 2.

1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
2. Thickness: As indicated on the drawings.

2.5 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corporation.
2. Guardian Fiberglass, Inc.
3. Johns Manville.
4. Knauf Fiber Glass.

5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

C. Thickness: As indicated on the drawings.

2.6 SPRAY POLYURETHANE INSULATING FOAM SEALANT

A. Closed-Cell Polyurethane Foam Insulation: ASTM 16, Type II, with maximum flame-spread and smoke-developed indexes of 10 and 20, respectively, per ASTM E 84.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Dow Chemical Company (The); Great Stuff Pro Window and Door Insulating Foam Sealant.

B. Minimum density of 1.5 lb/cu.ft.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.2 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 and that has not been left exposed at any time to ice and snow.

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. Provide sizes to fit applications indicated and selected from manufacturer’s standard thicknesses, widths, and lengths.

E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
6. Location:

   a. Exterior Walls: Thickness to provide R-19 minimum.
   b. Attic: Thickness to provide R-38 minimum.

D. Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

E. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.4 INSTALLATION OF CONTINUOUS INSULATION

A. Apply 2” diameter daubs of adhesive at each of the 4 corners of the board with one approximately in the middle (total of 5) on the inside face of insulation board.

B. Fit insulation between wall ties and other obstructions with joints staggered providing ¼’ to ½” spacing at end joints.

1. Press units firmly against inside wythe of masonry or other construction.
2. Make insulation continuous.

C. Fill all voids between insulation boards with single component insulating foam sealant to provide continuous vapor barrier.

D. Comply with insulation manufacturer’s written instructions applicable to products and applications indicated.

E. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

F. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

3.5 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072129 – SPRAY-APPLIED 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. Section Includes:

1. Spray-applied cellulose fiber insulation at the parking deck ceiling as indicated on the drawings.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for rigid and batt insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

C. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Evaluation Reports: For spray-applied insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

C. Products Specified by Flammability or Combustibility Criteria: Listed and classified by Underwriters Laboratories Inc.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: International Cellulose Corporation.

1. Product: K13.

2.2 CELLULOSE FIBER INSULATION

A. Cellulose Fiber Insulation: ASTM C 739; treated cellulose fiber, color as selected by Architect conforming to the following test requirements:

1. K factor: 0.22 K, when tested in accordance with ASTM C 177.
2. Density: 2 lb/cu ft, when tested in accordance with ASTM D 1622.
3. NRC: 0.75 for 1 inch thickness.
4. Moisture Absorption: Maximum 15 percent by weight.
5. Flame Spread and Smoke Developed Index: 10/0, when tested in accordance with ASTM E 84.
6. Combustibility: Passing ASTM E 136.
7. Color: As selected by the Architect from the manufacturer’s full range.

2.3 ACCESSORIES

A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are clean, dry, and free of matter that may inhibit adhesion.

B. Verify other work on and within spaces to be insulated is complete prior to application.

3.2 PREPARATION

A. Mask and protect adjacent surfaces from overspray or damage.

B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation to a uniform monolithic density without voids.

C. Install to achieve a thermal resistance R value or thickness as indicated on the drawings.

3.4 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION 072129

SECTION 072400.13 – DIRECT-APPLIED EXTERIOR SOFFIT 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. Section Includes:

1. Textured finish system for exterior gypsum board soffit and ceiling surfaces.

B. Related Sections:

1. Section 054000 "Cold-Formed Metal Framing" for exterior soffit framing.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Show locations and installation of control and expansion joints, substrate joints, cracks, flashing transitions, penetrations, corners, terminations, and tie-ins with adjoining construction, interfaces with separate materials that form part of the assembly including plans, elevations, sections, details of components, and attachments to other work.

C. Samples for Initial Selection: For each type of factory-prepared finish coat and for each color and texture specified.

D. Samples for Verification: For each type of factory-prepared finish coat and for each color and texture specified, 12 by 12 inches, and prepared on rigid backing.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: The textured finish system manufacturer shall be a company with at least thirty five years of experience in manufacturing specialty finishes and regularly engaged in the manufacture and marketing of products specified herein. The manufacturer shall have an ISO 9001:2008 certified quality system and ISO 14001:2004 certified environmental management system.

B. Installer's Qualifications: The contractor shall be qualified to perform the work specified by reason of experience. Contractor shall have at least 5 years of experience in commercial textured finish application, and shall have completed at least 3 projects of similar size and complexity. Contractor shall provide proof before commencement of work that he/she will maintain and supervise a qualified crew of applicators through the duration of the work. When requested Contractor shall provide a list of the last three comparable jobs including the name, location, and start and finish dates for the work.

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 for each substrate and finish texture indicated, including accessories.

a. Size: 100 sq. ft. in surface area.

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.

D. Testing: Testing shall be conducted as directed by the design professional, building owner, or owner’s representative/quality assurance agent to verify soffit/ceiling assembly performance and adhesion to prepared substrates.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover, and keep them dry and protected against damage from weather, moisture, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.7 FIELD CONDITIONS

A. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

1.8 WARRANTY

A. Provide manufacturers standard one year warranty for base coat materials and installation and minimum 10 years for acrylic finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: STO StoQuik Gold Finish System.

B. Other Acceptable Manufacturers:

1. Dryvit Systems, Inc.
2. Parex.

2.2 MATERIALS

A. Textured Finishes:

1. Stolit – high performance decorative and protective acrylic-based textured wall finish with integral color, complies with SCAQMD Rule 1113 for architectural finishes.

B. Primer:

1. Sto Primer – acrylic-based sanded primer, complies with SCAQMD Rule 1113 for primers.

C. Base Coat:

1. Sto BTS Plus – one component polymer modified portland cement high build base coat.

D. Surface Reinforcement:

1. Sto Mesh – nominal 4.5 oz/yd^2 glass fiber reinforcing mesh treated for compatibility with Sto materials.

E. Gypsum Soffit Board:

1. Basis of Design Manufacturer and Product: Georgia-Pacific Gypsum LLC; DensGlass glass mat faced gypsum sheathing in compliance with ASTM C 1177.

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 the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Gypsum soffit board must be installed in conformance with the applicable building code and manufacturer’s written installation instructions. Gypsum soffit board surface must be clean, dry, and free of surface contamination. Gypsum soffit board surface shall not have planar irregularities in excess of 1/16 inch and shall be free of voids, cracks, and other surface defects.

B. Mixing: Mix Sto products in accordance with published literature. Refer to applicable Product Bulletins for specific information on use, handling, application, precautions, and limitations of specific products.

C. Application:

1. Install corrosion proof termination accessories with perforated flanges for keying of the base coat at junctures with penetrations such as soffit vents, electrical fixtures, and with abutting walls and columns. Install corrosion proof control joints with perforated flanges for keying of the base coat at intervals as required by the gypsum soffit board manufacturer.

2. Install nominal 1/8 inch base coat by trowel to the soffit/ceiling board surface. Work horizontally or vertically in strips of 40 inches, and immediately embed the mesh into the wet

base coat by troweling from the center to the edge of the mesh. Overlap mesh not less than 2-½ inches at mesh seams and feather at seams. Double wrap all inside and outside corners with minimum 8-inch overlap in each direction (except where corner bead is used at outside corners lap mesh over perforated flange of accessory). Avoid wrinkles in the mesh. The mesh must be fully embedded so that no mesh color shows through the base coat when it is dry. Re-skim with additional base coat if mesh color is visible. Overlap perforated flanges of accessories with the base coat/reinforcing mesh application. Do not install base coat and mesh onto solid (unperforated) portions of accessories.

3. When the base coat application is dry apply the primer by brush or roller to the entire base coat surface.

4. When the primer application is dry apply the textured finish by trowel. Apply finish in a continuous application, and work to a wet edge. Float the finish to achieve the desired texture.

2.4 PROTECTION

A. Provide protection of installed materials from water infiltration into or behind them during and after construction.

B. Provide protection of installed materials from dust, dirt, precipitation, freezing and continuous high humidity until they are fully dry.

C. Seal penetrations through the finished surface with backer rod and sealant or other appropriate means.

END OF SECTION 072400.13

SECTION 072613 – UNDER-SLAB VAPOR RETARDERS

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. Section includes sheet vapor retarders.

B. Related Sections include the following:

1. Section 033000 “Cast-in-Place Concrete.”

1.3 PERFORMANCE REQUIREMENTS

A. General: ASTM E1745, Class A vapor retarder shall be capable of performing as a continuous vapor retarder.

B. Water Vapor Transmission Rate: Not to exceed 0.06 WVTR when tested in accordance with ASTM E 96.

1.4 ACTION SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating and preparing substrate; technical data; and tested physical and performance properties of vapor retarder.

B. Shop Drawings: Show locations and extent of vapor retarder. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1. Include details of interfaces with other materials that form part of vapor retarder.
2. Include details of mockups.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For vapor retarders, certifying compatibility of vapor retarders and accessory materials with Project materials that connect to or that come in contact with vapor retarders; signed by product manufacturer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for vapor retarders.

PART 2 - PRODUCTS

2.1 UNDER-SLAB VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fortifiber Building Systems Group; Moistop Ultra 15.
b. Meadows, W.R.., Inc.; Perminator 15 mil.
c. Raven Industries Inc.; Vapor Block 15.
d. Reef Industries, Inc.; Griffolyn 15 mil Green.
e. Stego Industries, LLC; Stego Wrap 15 mil Class A.

2.2 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by vapor retarder manufacturer for intended use and compatible with vapor retarder.

B. Seam Tape: Recommended by manufacturer of vapor retarder material.

C. Mastic: Recommended by manufacturer of vapor retarder.

D. Pipe Boots: Construct pipe boots from vapor retarder material, pressure sensitive tape and/or mastic per manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install vapor retarder according to manufacturer's written instructions and according to recommendations in ASTM E 1643.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.2 CLEANING AND PROTECTION

A. Protect vapor retarder system from damage prior to installation of cast-in-place concrete according to manufacturer's written instructions.

B. Repair vapor retarder according to manufacturer's written instructions.

END OF SECTION 072613

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

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. Vapor-permeable, fluid-applied air barriers.

1.3 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

3. Include details of interfaces with other materials that form part of air barrier.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 HIGH-BUILD AIR BARRIERS, VAPOR PERMEABLE

A. High-Build, Vapor-Permeable Air Barrier: Modified bituminous membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.

1. Synthetic Polymer Type:

   a. Manufacturers: Subject to compliance with requirements, provide products by the following:

      1) Henry Company, Sealants Division.

         (a) Product: Air-Bloc 17MR.

2. Physical and Performance Properties:

   a. Color: Graphite.
   b. Solids Content:

      1) By Weight: 63%.
      2) By Volume: 53%.

   c. Service Temperature:

      1) Low Temperature: -40 degrees F (-40 degrees C).
      2) High Temperature: +180 degrees F (+80 degrees C).

   d. Application Temperature:

      1) Low Temperature: +20 degrees F (-6 degrees C).
      2) High Temperature: +122 degrees F (+50 degrees C).

   e. Tensile Strength (ASTM D412): 104 psi.
   f. Elongation (ASTM D412): 420%.
   g. Low Temperature Flexibility @ -22 degrees F (-30 degrees C) (ASTM D1970): Pass.
   h. Freeze-Thaw Resistance (ASTM D2243): Pass; 10 cycles.
   i. Nail Sealability (ASTM D1970): Pass.
   j. VOC Content: 100 grams/liter max.
   k. Water Absorption (ASTM D471, modified): 5.6%.
   l. Water Vapor Permeance (ASTM E96 B) @ 40 mils nominal dry film: 14 perms.
   m. Air Permeability:

      1) Assembly Air Leakage (ASTM E2357): Pass.
      2) Building Material (ASTM E2178): 0.0001 cfm/ft2.

   n. Chemical Resistance: Resists salt solutions, mild acids and alkalis. Non-resistant to oils, grease or solvents.
   o. Fire Testing (NFPA 285): Complies in various assemblies.
   p. Flame Spread/Smoke Development (ASTM E84): 10/15.
   q. Resistance to Mold, Mildew, and Fungal Growth (ASTM D5590): No growth.

2.3 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Transition Membranes:

   1. Liquid Applied Flashings:

a. Moisture-curing one component elastomeric liquid applied flashing membrane using a highly advanced STPe (Silyl-Terminated Polyether) polymer, having the following properties:

1) Basis of Design Product: Air-Bloc LF.
2) Color: Blue.
3) Air Leakage (ASTM E2178): <0.004 L/s/m^2 @ 75Pa.
4) Water Vapor Permeance (ASTM E96, Method B): 21.8 perms @25 mils.
5) Air Leakage of Air Barrier Assemblies (ASTM E2357): Pass.
6) Water Resistance (AC212/ASTM D2247): Pass.
7) Nail Sealability (AMMA 711): Pass.
8) Surface Burning Characteristics (ASTM E84):

a) Class A.
b) Flame Spread/Smoke Development (ASTM E84): 20/5.

9) Tensile Strength (ASTM D412): 132 psi.
10) Elongation (ASTM D412): 264%.

2. Self-Adhering Flashings:

a. Non-vapor permeable, self-adhered water resistive air and vapor barrier membrane consisting of an SBS rubberized asphalt compound, which is integrally laminated to a blue engineered thermoplastic film, having the following properties:

1) Basis of Design Product: Blueskin SA.
2) Color: Blue.
3) Water Vapor Permeance (ASTM E96, Method A): .86 perms.
4) Air Leakage of Air Barrier Assemblies (ASTM E2357): Pass.
5) Air Leakage (ASTM E2178): <0.0005 L/s/m^2 @ 75Pa.
6) Water Tightness (CAN/CGSB-37.58-M86): Pass.
7) Nail Sealability (ASTM D1970): Pass.
8) Tensile Strength:

a) Membrane (ASTM D412-modified): 500 psi minimum.
b) Film (ASTM D828): 5000 psi minimum.

9) Elongation (ASTM D412-modified): 200% minimum.

3. Sheathing Joint Membranes:

a. Vapor permeable, self-adhered water resistive air barrier membrane consisting of an engineered film and patented, permeable adhesive technology with split-back poly-release film, having the following properties:

1) Basis of Design Product: Blueskin VP160
2) Color: Blue.
3) Air Leakage (ASTM E2178): <0.02 L/s/m^2 @ 75Pa.
4) Water Vapor Permeance (ASTM E96, Method A): 29 perms.
5) Air Leakage of Air Barrier Assemblies (ASTM E2357): Pass.
6) Resistance to Water Penetration (ICC-ES AC 38): Pass.
7) Nail Sealability (ASTM D1970): Pass.
8) Surface Burning Characteristics (ASTM E84):

a) Class A.
b) Flame Spread/Smoke Development (ASTM E84): 0/105.

9) Tensile Strength (ASTM D828): 182N MD/129N CD.
10) Cycling and Elongation (ICC-ES AC48): Pass.

4. Adhesives and Primers:
    a. Spray adhesive, and having the following properties:
        1) Basis of Design Product: Blueskin Spray Prep.
        2) Color: Clear amber.
        3) Solids Content (By Weight): 35%.
        4) Aerosol.
    b. Synthetic rubber based adhesive type, quick setting, having the following properties:
        1) Basis of Design Product: Blueskin Adhesive.
        2) Color: Blue.
        3) Solids Content (By Weight): 35%.
        4) Aerosol.
    c. Synthetic rubber based adhesive type, quick setting, having the following properties:
        1) Basis of Design Product: Blueskin Adhesive.
        2) Color: Blue.
        3) Solids Content (By Weight): 35%.
        4) Solvent based: Maximum VOC: 450 g/L.
    d. Polymer emulsion based adhesive type, quick setting, low VOC content, having the following properties:
        1) Basis of Design Product: Blueskin LVC Adhesive.
        2) Color: Blue.
        3) Solids Content (By Weight): 40%.
        4) Solvent based: 240 g/L.
    e. Polymer emulsion based primer for self-adhered membranes and having the following properties.
        1) Basis of Design Product: Aquatac Primer.
        2) Color: Aqua.
        3) Solids Content (By Weight): 58%.
        4) Water based: Maximum VOC: 50 g/l.
5. Sealants:
    a. Building Envelope Sealant:
        1) Moisture cure, medium modulus polymer modified sealing compound, having the following properties:
            a) Basis of Design Product: HE925 BES Sealant.
            b) Complies with Fed. Spec. TT-S-00230C, Type II, Class A.
            c) Complies with ASTM C920, Type S, Grade NS, Class 35.
            d) Elongation: 450 – 550%.
            e) Remains flexible with aging.
    b. Sheathing Joint Sealants:
        1) As recommended by the Manufacturer.
6. Self-Adhesive Thru-Wall Flashing Membrane:
    a. Non-vapor permeable, self-adhered water resistive air and vapor barrier membrane consisting of an SBS rubberized asphalt compound, which is integrally laminated to a blue engineered thermoplastic film, having the following properties:

1) Basis of Design Product: Blueskin TWF.
2) Color: Yellow.
3) High Temperature Stability - Flow Resistance (ASTM D5147): Pass.
4) Air leakage (ASTM E283): 0.005 L/s.m² @ 75 Pa.
5) Water vapor permeance (ASTM E96, Method B): 0.03 perms.
6) Low temperature flexibility (CGSB 37-GP-56M): Pass.

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 substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D 4263.
4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Hot weather or direct-sun applications over porous substrates, such as concrete, promote rapid surface drying and can form blisters in the fluid applied membrane air barrier during curing. To aid in blister prevention prepare substrate in accordance with one of the following optional procedures:

1. Prime coat:
    a. Apply a thin prime coat of fluid applied membrane air barrier to substrate.
    b. Allow fluid applied membrane air barrier to fully cure prior to subsequent application.
    c. Install primary fluid applied membrane air barrier to the Manufacturer’s minimum recommended mil thickness.
2. Two coat:
    a. Apply fluid applied membrane air barrier to achieve one-half (1/2) of minimum recommended mil thickness.
    b. Allow fluid applied membrane air barrier to fully cure prior to subsequent application.

c. Apply fluid applied membrane air barrier to achieve one-half (1/2) of minimum recommended mil thickness.
d. Overall dry mil thickness shall be in accordance with the Manufacturer's published literature.

3.3 INSTALLATION

A. Ensure substrate is ready to receive fluid applied membrane air barrier in accordance with published literature.

B. If fluid applied membrane air barrier should freeze while in storage, move containers to a controlled environment above 32 degrees F (0 degrees C) until thawed and re-mix using a hand operated power mixer prior to use.

C. Fluid applied membrane air barrier shall not be applied when ambient (air) and substrate temperatures are below 20 degrees F (-6 degrees C).

D. Do not proceed with application of air barrier membrane when rain is expected within 16 hours.

E. Apply sealant at sharp corners, changes in substrate plane, penetrations, and edges to form a smooth transition from one plane to another.

F. Non-Moving Substrate Joint and Crack Treatment:

1. Gaps equal to or less than 3/8 inch wide:
    a. Sheathing Joint Sealant:
        1) Apply sealant at rate recommended by the Manufacturer.
        2) Spread sealant at joint extending a minimum one (1) inch beyond gap to ensure a continuous air and watertight assembly.
2. Gaps equal to or less than 1/2 inch wide:
    a. Building Envelope Sealant:
        1) Apply sealant at rate recommended by the Manufacturer.
        2) Spread sealant at joint extending a minimum one (1) inch on each side of substrate gap.
    b. Liquid Applied Flashings:
        1) Apply liquid applied flashing at rate recommended by the Manufacturer.
        2) Apply liquid applied flashing in accordance with the Manufacturer's published literature extending a minimum of two (2) inches on each side of substrate gap.
    c. Self-Adhering Flashings:
        1) Apply primer to substrate and allow curing in accordance with published literature prior to installation of self-adhered flashing.
        2) Apply self-adhering flashing in accordance with the Manufacturer's published literature extending a minimum of three (3) inches on each side of substrate gap.
        3) Roll membrane with countertop roller to eliminate air pockets between self-adhered flashing and substrate ensuring full adhesion of membrane onto substrate.
        4) Seal exposed leading edges of self-adhered membrane with sealant.

3. Gaps greater than 1/2 inch wide: As recommended by the Manufacturer.

G. Moving Joints: As recommended by the Manufacturer.

H. Primary Liquid Air Barrier Membrane:

1. Install fluid applied membrane air barrier in accordance with Air Barrier Manufacturer published literature to ensure an air and watertight fluid applied membrane air barrier assembly.
2. Fluid applied membrane air barrier assembly must be installed in a monolithic application without sags, runs or voids, and transitioning with auxiliary components to create a uniform drainage plane and air barrier.
3. Install fluid applied membrane air barrier and transition membranes so that subsequent membrane installation laps one (1) inch (2.5 cm) onto existing membrane ensuring an air and watertight fluid applied membrane air barrier assembly.
4. Fluid applied membrane air barrier total dry thickness shall be in accordance with the Manufacturer published literature. Refer to the Manufacturer's Technical Data Sheet.

I. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.4 FIELD QUALITY CONTROL

A. Final Observation and Verification:

1. Final inspection of fluid applied membrane air barrier assembly shall be carried out by the Owner's representative, the contractor, or Air Barrier Manufacturer as required by warranty.
2. Contact Air Barrier Manufacturer for warranty issuance requirements.

B. Fluid applied membrane air barrier assembly is not designed for permanent UV exposure. Refer to Air Barrier Manufacturer published literature for product limitations.

3.5 CLEANING

A. Promptly as the Work proceeds, and upon completion, clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing Work.

B. Clean soiled surfaces, spatters, and damage caused by Work of this Section.

C. Check area to ensure cleanliness and remove debris, equipment, and excess material from the site.

END OF SECTION 072726

SECTION 073216 - CONCRETE ROOF TILES

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 roof tiles.
2. Underlayment.
3. Ridge vents.
4. Metal flashing and trim.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079, glossaries in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and NRCA's "NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1. Concrete Roof Tiles: Full size, showing full range of color values and blends.
2. Accessory Tiles: Full size, each type.
3. Metal Valley Flashing: 12 inches square.
4. Ridge Vents: 12-inch long Sample.

C. Wind Calculations for Wood Nailers: Submit wind calculations indicating that the roof wood nailers meet the wind uplift pressures on elevations greater than 40 feet as required by the Florida Building Code. Calculations shall be signed and sealed by a licensed engineer registered in the State of Florida.

1.6 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each type of concrete roof tile, based on evaluation of comprehensive tests performed by a qualified testing agency.

B. Evaluation Reports: From ICC-ES or other testing and inspecting agency acceptable to authorities having jurisdiction, indicating that product is suitable for intended use under applicable building codes for the following:

1. Concrete roof tiles.
2. Synthetic underlayment.
3. High-temperature self-adhering underlayment.
4. Tile attachment systems.

C. Sample Warranty: Manufacturer's materials warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing to include in maintenance manuals.

1.8 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. Concrete Roof Tiles: 100 sq. ft. of each type, in unbroken bundles.

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 materials and execution.

1. Build mockups for concrete roof tiles including related roofing materials.
   a. Size: 48 inches long by 48 inches wide.
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.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store underlayment rolls in a dry, well-ventilated location protected from weather, sunlight, and moisture according to manufacturer's written instructions.

1. Store on end, on pallets or other raised surfaces. Do not double stack rolls.

B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

C. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be installed according to manufacturer's written instructions and warranty requirements.

1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.12 WARRANTY

A. Materials Warranty: Standard form in which manufacturer agrees to repair or replace concrete roof tiles that fail in materials within specified warranty period.

1. Warranty Period: 50 years from date of Substantial Completion.

B. Roofing Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of concrete-tile roofing 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. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure as indicated on the structural drawings.

B. Exterior Fire-Test Exposure: Provide concrete roof tiles and related roofing materials identical to those of assemblies tested for Class A fire resistance according to ASTM E 108 or UL 790 by Underwriters Laboratories, Inc. or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

C. Comply with the latest edition of the Florida Building Code, High Velocity Hurricane Zone.

1. Miami-Dade County, Product Control Notice of Acceptance.

2.2 CONCRETE ROOF TILES

A. Concrete Roof Tiles: ASTM C 1492, molded- or extruded-concrete roof tile units of shape and configuration indicated, with integral color, and free of surface imperfections. Provide with fastening holes pre-punched at factory.
1. Basis of Design Manufacturer: Subject to compliance with requirements, provide products by the following:

a. Manufacturer: Westlake Royal Roofing, LLC.
b. Product: Barcelona 900.

2. Weight: Normal.
3. High-Profile Shape: Type I, Spanish or "S".

a. Accessory Tiles: Type IV, ridge, ridge vent, ridge end, starter, eave closure, rake tile, top closure tile, hip tile, metal flashing sleeve, end band and terminal units.

4. Size: 17” long by 13” wide by ½” thick.
5. Finish and Texture: Matte, smooth.
6. Colors Name: Gold Dust Blend.

2.3 UNDERLAYMENT MATERIALS

A. Felt Underlayment: ASTM D 2626/D 2626M, asphalt-saturated and -coated organic felt, fine mineral surfacing on both sides, unperforated.

B. Self-Adhering Sheet Underlayment, High Temperature: Minimum of 40-mil thick; with slip-resisting, polymer-film-reinforced or glass-reinforced top surface laminated to layer of butyl or SBS-modified-asphalt adhesive; with release backing; cold applied; and evaluated and documented to be suitable for use for intended purpose under applicable codes by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlisle Coatings & Waterproofing Inc.
b. Grace Construction Products; W.R. Grace & Co. -- Conn.
c. Henry Company.
d. Owens Corning.

2. Thermal Stability: Stable after testing at 240 deg F (116 deg C) according to ASTM D 1970/D 1970M.
3. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C) according to ASTM D 1970/D 1970M.

2.4 PLASTIC RIDGE VENTS

A. Rigid-Plastic Ridge Vent: Manufacturer's standard, rigid section high-density polypropylene or other UV-stabilized plastic ridge vent for use under ridge tiles.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Cor-A-Vent, Inc.; Model V-600TE.

2. Minimum Net Free Area: 20 sq in per lin ft.
3. Dimensions: 3-1/2 inches wide by 48 inches long by 1 inch high.
4. Color: Black.

2.5 STATIC VENT SYSTEM

A. Static Vent System: Prefabricated steel static vent system for barrel vault tile.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Manufacturer: Boral Roofing.
   b. Product: EZ Vent.

2. Material: 26 ga. Steel.
3. Dimensions: 14 inches wide by 47 inches long by 3 inches high.
4. Color: Match adjacent roofing tile..

2.6 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D 4586/D 4586M, Type II, asbestos free.

B. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.

C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane-based joint sealant of type, grade, class, and use classifications required to seal joints in concrete-tile roofing and remain watertight.

D. Cold-Applied Adhesive: Manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with underlayments.

E. Mortar: ASTM C 270, Type M, with ASTM C 979/C 979M, pigmented mortar matching the color of concrete roof tiles for exposed-to-view mortar, and natural color for concealed-from-view mortar.

F. Foam Adhesive: Two-component, polyurethane expanding adhesive recommended for application by concrete-roof-tile manufacturer.

G. Ridge Closure: Manufacturer's standard EPDM ridge closure, formed to shape of concrete roof tiles.

H. Wood Nailers: Comply with requirements for pressure-preservative-treated wood in Section 061000 "Rough Carpentry."

I. Mesh Fabric: 18-by-14 mesh of PVC-coated, glass-fiber thread.

2.7 FASTENERS

A. Roofing Nails: ASTM F 1667, hot-dip galvanized-steel, 0.120-inch diameter shank, sharp-pointed, conventional roofing nails with barbed shanks; minimum 3/8-inch diameter head; of sufficient length to penetrate 3/4 inch into substrate or through thickness of the sheathing, whichever is less.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

B. Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile metal or plastic caps, 1-inch minimum diameter.

1. Provide cap nails complying with written instructions of synthetic-underlayment manufacturer.
2. Provide with minimum 0.0134-inch thick cap, and with minimum 0.105-inch thick shank of length to penetrate at least 3/4 inch into roof sheathing.

C. Wood Batten Nails: ASTM F 1667; common or box, steel wire, flat head, and smooth shank.

D. Wire Ties: Stainless steel, 0.083-inch minimum diameter.

E. Twisted-Wire-Tie System: Continuously twisted, two-wire unit with loops formed 6 inches apart, minimum 0.090-inch diameter stainless steel wire and 0.063-inch diameter stainless steel tie wires, with matching-metal folding clip anchors.

F. Hook Nails: One-piece wind lock and concrete roof tile fastener system, minimum 0.120-inch diameter stainless-steel wire, for direct deck nailing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Newport Tool & Fastener Company, Inc.
b. Wire Works, Inc.

G. Tile Locks: Stainless-steel, 0.1-inch diameter wire device designed to secure butt edges of overlaid concrete roof tiles.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Newport Tool & Fastener Company, Inc.
b. Wire Works, Inc.

H. Storm Clips: Stainless-steel, minimum 0.048-by-1/4-inch strap-type, L-shaped retainer clips designed to secure side edges of concrete roof tiles. Provide with two fastener holes in base flange.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Newport Tool & Fastener Company, Inc.
b. Wire Works, Inc.

2.8 METAL FLASHING AND TRIM

A. General: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for design, dimensions, metal, and other characteristics of the item.

1. Apron Flashings: Fabricate with lower flange extending a minimum of 4 inches over and 4 inches beyond each side of downslope tile roofing and 6 inches up the vertical surface.

2. Step Flashings: Fabricate with a head lap of 3 inches and a minimum extension of 4 inches both horizontally and vertically.
3. Cricket and Backer Flashings: Fabricate with concealed flange extending a minimum of 24 inches beneath upslope tile roofing, 6 inches beyond each side of skylight, and 6 inches above the roof plane.
4. Valley Flashings: Fabricate in lengths not exceeding 10 feet, with 1-inch high, inverted-V-profile water diverter at center of valley and with equal flange widths of 12 inches.

    a. Color: Prefinished valley flashings shall match the concrete roof tile color.

5. Drip Edges: Fabricate in lengths not exceeding 10 feet, with 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.

C. Sheet Metal Ridge Vent: Fabricate from 16-oz./sq. ft. thick copper sheet, terminating each side in V-shaped external baffles with venting holes producing net-free ventilating area of 2.65 sq. in./ft.

D. Vent-Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches from pipe onto roof.

E. Lead Sheet Flashing: ASTM B749 lead sheet.

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.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provision has been made for flashings and penetrations through roofing.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. General: Comply with concrete roof tile manufacturer's written instructions and with recommendations in NRCA's "NRCA Roofing Manual: Steep-Slope Roof Systems" unless more stringent requirements are indicated.

1. Cover wood nailers with underlayment strips.

B. Double-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch wide starter course at eaves and completely cover with a 36-inch wide second course. Install succeeding 36-inch wide courses lapping previous courses 19 inches in shingle

fashion. Lap ends a minimum of 6 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with underlayment nails.

1. Install fasteners at no more than 12 inches o.c. between side laps and 6-inch spacing at side laps.
2. Install felt underlayment on roof sheathing not covered by self-adhering sheet underlayment. Lap edges over self-adhering sheet underlayment not less than 4 inches where overlap is in direction that sheds water.
3. Terminate felt underlayment extended up not less than 4 inches against sidewalls, curbs, chimneys, and other roof projections.

C. Double-Layer Felt/Roll-Roofing Underlayment:

1. Install single layer of felt underlayment on roof deck parallel with and starting at the eaves. Lap sides a minimum of 4 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with underlayment nails.
2. Install roll-roofing underlayment, in parallel courses, on felt underlayment and in same direction. Lap sides a minimum of 4 inches. Lap ends a minimum of 6 inches. Stagger end laps between succeeding courses at least 72 inches.
    a. Mechanically fasten over felt underlayment with fasteners located under side lap.
    b. Adhere to felt underlayment with uniform coating of cold-applied adhesive.
3. Terminate felt underlayment extended up not less than 4 inches against chimneys, sidewalls, curbs, and other projections.

D. Self-Adhering Sheet Underlayment: Install wrinkle free; comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install lapped in direction that sheds water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches, staggered 24 inches between succeeding courses. Roll laps with roller. Cover underlayment within seven days.
1. Extend self-adhering sheet underlayment over entire roof deck.
2. Eaves: Extend from edges of eaves 24 inches beyond interior face of exterior wall.
3. Rakes: Extend from edges of rakes 24 inches beyond interior face of exterior wall.
4. Valleys: Extend from lowest to highest point 18 inches on each side.
5. Hips: Extend 18 inches on each side.
6. Ridges: Extend 36 inches on each side without obstructing continuous ridge vent slot.
7. Sidewalls: Extend 18 inches beyond sidewalls and return vertically against sidewalls not less than 4 inches.
8. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend 18 inches beyond penetrating elements and return vertically against penetrating elements not less than 4 inches.
9. Roof-Slope Transitions: Extend 18 inches on each roof slope.

E. Valley Underlayment: Install two layers of 36-inch wide felt underlayment centered in valley. Stagger end laps between layers at least 72 inches. Lap ends of each layer at least 12 inches in direction that sheds water, and seal with asphalt roofing cement. Fasten each layer to roof deck with underlayment nails.

1. Lap roof-deck underlayment over first layer of valley underlayment at least 6 inches.

3.3 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

1. Install metal flashings according to concrete roof tile manufacturer's written instructions and recommendations in NRCA's "NRCA Roofing Manual: Steep-Slope Roof Systems."

B. Apron Flashings: Extend lower flange over and beyond each side of downslope tile roofing and up the vertical surface.

C. Step Flashings: Install with a head lap of 3 inches and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying tile. Fasten to roof deck only.

D. Cricket and Backer Flashings: Install against roof-penetrating elements, extending concealed flange beneath upslope tile roofing and beyond each side.

E. Valley Flashings: Install centrally in valleys, lapping ends at least 8 inches in direction that sheds water. Fasten upper end of each length to roof deck beneath overlap.

1. Secure hemmed flange edges into metal cleats spaced 12 inches apart and fastened to roof deck.
2. Adhere 9-inch wide strips of self-adhering sheet underlayment to metal flanges and to roof-deck underlayment. Extend 4 inches over metal flanges.

F. Channel Flashings: Install over underlayment and fasten to roof deck.

G. Rake Pan Flashings: Install over underlayment and fasten to roof deck.

H. Rake Drip Edges: Install over underlayment and fasten to roof deck.

I. Eave Drip Edges: Install beneath underlayment and fasten to roof deck.

J. Pipe Flashings: Form flashing around pipe penetrations and tile roofing. Fasten and seal to tile roofing.

3.4 WOOD NAILERS

A. Install wood nailers securely fastened to roof deck at the following locations:

1. Hips.
2. Ridges.
3. Rakes.

B. Install beveled wood cant at eaves and securely fasten to roof deck.

C. Install nominal 1-by-2-inch wood battens horizontally in 48-inch lengths with ends separated by 1/2 inch, at spacing required by concrete roof tile manufacturer, and securely fasten to roof deck.

3.5 CONCRETE ROOF TILE INSTALLATION

A. General: Install concrete roof tiles according to manufacturer's written instructions and with recommendations in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions" and NRCA's "NRCA Roofing Manual: Steep-Slope Roof Systems" unless more stringent requirements are indicated.

1. Maintain uniform exposure and coursing of concrete roof tiles throughout roof.
2. Extend tiles 2 inches over eave fasciae.
3. Nail Fastening: Drive nails to clear the concrete roof tile so the tile hangs from the nail and is not drawn up.
    a. Install wire through nail holes of cut tiles that cannot be nailed directly to roof deck, and fasten to nails driven into deck.
4. Storm Clips: Install to capture edges of longitudinal sides of concrete roof tiles and securely fasten to roof deck.
5. Tile Locks: Install to support and lock overlying tile butts to underlying tiles.
6. Cut and fit concrete roof tiles neatly around roof vents, pipes, ventilators, and other projections through roof. Fill voids with mortar.
7. Install concrete roof tiles with color blend approved by Architect.

B. High-Profile Concrete Roof Tile Installation:

1. Install tile eave closure.
2. Provide minimum 3-inch lap between succeeding courses of concrete roof tiles.
3. Install rake tiles indicated.
4. Install ridge tiles with laps facing away from prevailing wind. Seal laps with butyl sealant.

C. Open Valleys: Cut concrete roof tiles at open valleys to form straight lines. Maintain uniform width of exposed open valley from highest to lowest point.

1. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
2. Do not nail tiles to metal flashings.

D. Closed Valleys: Cut concrete roof tiles at closed valleys to form straight lines, trimming upper concealed corners of tiles. Maintain uniform gap of 1/2 to 3/4 inch on either side of the water diverter at centerline of valley.

1. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
2. Do not nail tiles to metal flashings.

3.6 PLASTIC RIDGE VENTS

A. Rigid-Plastic Ridge Vents: Install continuous ridge vents over concrete roof tiles according to manufacturer's written instructions. Fasten with nails of sufficient length to penetrate substrate.

3.7 ADJUSTING AND CLEANING

A. Remove and replace damaged or broken concrete roof tiles.

B. Remove excess concrete roof tiles and debris from Project site.

3.8 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("the work") on the following project:

1. Owner:
2. Address:
3. Building Name/Type:
4. Address:
5. Area of the Work:
6. Acceptance Date:
7. Warranty Period:
8. Expiration Date:

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant the 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 he will, at his own cost and expense, make or cause to be made such repairs to or replacements of the work as are necessary to correct faulty and defective work and as are necessary to maintain the 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 the work and other parts of the building, and to building contents, caused by:

    a. Lightning;
    b. Peak gust wind speed exceeding _____ 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 the 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 the 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 the work.
4. During Warranty Period, if Owner allows alteration of the 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 the alterations, but only to the extent the alterations affect the work covered by this Warranty. If Owner engages Roofing Installer to perform the alterations, Warranty shall not become null and void unless Roofing Installer, before starting the alterations, notified Owner in writing, showing reasonable cause for claim,

that the alterations would likely damage or deteriorate the 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 use or service more severe than originally specified, this Warranty shall become null and void on date of the change, but only to the extent the change affects the 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 the 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 the 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 the 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 073216

SECTION 074213.57 – LINEAR METAL SOFFIT 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. Perforated and non-perforated metal ceiling panels.
2. Suspension systems.
3. Accessories; provide other necessary items including devices for attachment overhead construction, secondary members, splines, splices, connecting clips, wall connectors, wall angles, and other devices required for a complete installation.
4. Supplemental support framing: Provide fully engineered secondary framing as required to meet code, conforming to layout shown in drawings, to support direct-hung metal ceilings suspension system.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct a conference, prior to start of installation, to review system requirements, shop drawings, and all coordination needs.

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 each type of panel and accessory.

B. Shop Drawings: Submit shop drawings for reflected ceiling plans (RCP's), drawn to scale, and indicating penetrations and ceiling mounted items. Show the following details

1. Reflected Ceiling Plan(s): Indicating metal ceiling layout, ceiling mounted items and penetrations.
2. Suspension System, Carrier and Component Layout.
3. Details of system assembly and connections to building components.

C. Samples for Verification: Full-size units (or as specified below) of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics. Submit samples for each type specified.

1. 11" square metal panel units.
2. 11" long samples of each exposed molding or trim.
3. 11" long samples of each suspension component.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer/Installer Qualifications:

1. Provide metal ceiling system components produced by a single manufacturer with a minimum 10 years' experience in actual production of specified products and with resources to provide consistent quality in appearance and physical properties, including production in an environmentally controlled indoor factory facility and having previously certified Miami-Dade County NOA certifications.
2. Provide suspension system components produced by a single manufacturer to provide compatible components for a complete metal ceiling system installation.
3. Perform installations using a firm with installers having no less than 3 years of successful experience on projects of similar size and requirements.

B. Regulatory Requirements:

1. Fire Rating Performance Characteristics: Install system to provide a flame spread of 0 - 25, complying with certified testing to ASTM E 84.
2. Structural Criteria: Install and certify system to comply with structural and wind load requirements of governing codes.
3. Installation Standard for Suspension System: Comply with ASTM C 636.
4. Wind Load: Per code. Designed and tested in accordance with the requirements of the Florida Building Code, including the High Velocity Hurricane Zone (HVHZ) provisions and Miami-Dade requirements. Miami-Dade County, Florida Notice of Acceptance No. 20-0203.01 (expires 3/19/25).

C. Mock-Up: Prior to beginning installation erect a mock-up section, where directed, using all system components.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver system components in manufacturer's original unopened packages, clearly labeled.

B. Store components in fully enclosed dry space. Carefully place on skids, to prevent damage from moisture and other construction activities.

C. Handle components to prevent damage to surfaces and edges, and to prevent distortion and other physical damage.

1.9 PROJECT CONDITIONS

A. Begin system installations only after spaces are enclosed and weather-tight, and after all wet work and overhead work have been completed.

B. Prior to starting installations, allow materials to reach ambient room temperature and humidity intended to be maintained for occupancy.

1.10 WARRANTY

A. Provide specified manufacturer's warranty against defects in workmanship, discoloration, or other defect considered undesirable by the Architect or Employer.

B. This warranty shall remain in effect for a minimum period of one (1) year from date of Substantial Completion.

1.11 MAINTENANCE AND EXTRA MATERIALS

A. Maintenance Instructions: Provide manufacturer's standard maintenance and cleaning instructions for finishes provided.

B. Extra Materials: Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Only typical system components are included with attic stock.

1. Acoustical Metal Ceiling Pan Units: Full-size units equal to two percent (2%) of amount installed.
2. Ceiling Suspension System Components: Quantity of each grid and exposed component equal to two percent (2%) of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer and Product:

1. Manufacturer: CertainTeed Architectural.
2. Product: 150F Metal Plank Ceiling System.

2.2 MATERIALS

A. Linear metal plank soffit system for exterior installations:

1. Miami-Dade County, Florida Notice of Acceptance No. 20-0203.01 (expires 3/19/25).

B. Panel Profile Type: 150F, roll formed .025" thick aluminum; 5-29/32" wide, ¾" deep, with square interlocking, integral reveal closure edges.

1. Length: Standard 12'.

C. Perforations for Ventilation Only:

1. Pattern: Perforation Vent Panel #124.
2. Percentage of soffit: 10% max.

D. Panel Finish: Paint; color and pattern shall be selected by the Architect from the manufacturer's full range.

1. Decorated Wood-Look Powder Coat.

2.3 ACCESSORY MATERIALS

A. Panel Splice: Formed aluminum finished in matching color.

B. Edge trim: Manufacturer's standard edge trim moldings.

C. Air Distribution Devices: Provide distribution devices that are independently suspended, relocatable, adjustable from below finished ceiling, and capable of being concealed behind (invisible to view) and fully integrated with ceiling system so as to allow no interruption of ceiling components:

D. Lighting Fixtures: Provide fixtures capable of being fully integrated with ceiling system and requiring no interruption of ceiling components, that are independently suspended, and as selected to conform to lighting criteria specified.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and structural framing to which acoustical metal panels attach or abut, with installer present, for compliance with requirements specified in this and other Sections that affect installation and anchorage, and other conditions affecting performance of metal panel ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.

B. Measure each ceiling area and establish layout of acoustical metal pan units to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width units at borders, and comply with layout shown on reflected ceiling plans.

C. Survey substrate for wall attachment to assure squareness and proper elevation for wall panel installation.

3.3 INSTALLATION

A. General: Install acoustical metal pan ceilings, per manufacturers shop drawings provided, per manufacturer's written instructions and to comply with publications referenced below:

1. CISCA "Ceiling Systems Handbook.
2. Standard for Ceiling Suspension System Installations - ASTM C 636.
3. Standard for Ceiling Suspension Systems Requiring Seismic Restraint - ASTM E 580.

B. Suspend ceiling hangers from building's approved structural substrates 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, counter-splaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacing that interfere with location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Utilize supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Where used 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; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Space hangers not more than 48” on-center, along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 12” from ends of each member. Supply supporting calculations from licensed Structural Engineer verifying hanger spacing meets all requirements, when spacing exceeds those recommended.
6. Level grid to 1/8” in 10’ from specified elevation(s), square and true.
7. Adjust suspension system runners so they are square (within .5 degree from 90 degrees) and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

C. Secure bracing wires to ceiling suspension members and to supports acceptable to Architect/Engineer and/or inspector. Suspend bracing from building's structural members and/or structural deck, as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs (unless directed otherwise).

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical metal pan. Method of edge trim attachment and design of edge trims to be approved by Architect.

1. Screw attach moldings to substrate at intervals not more than 18” on-center and not more than 6” from ends, leveling with ceding suspension system to a tolerance of 1/8” in 10’. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim without prior written approval, or unless detailed otherwise.

E. Scribe and cut acoustical metal panel units for accurate fit at 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.

F. Install acoustical metal panel units in coordination with suspension system. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.

3.4 CLEANING AND PROTECTION

A. Adjust components to provide uniform tolerances.

B. Replace all ceiling panels that are scratched, dented or otherwise damaged.

C. Clean exposed surfaces with non-solvent, non-abrasive commercial type cleaner.

END OF SECTION 074213.57

SECTION 074646 - FIBER-CEMENT SOFFIT

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 fiber-cement soffit.

B. Related Requirements:

1. Section 014000 “Quality Requirements” for integrated exterior mock-up requirements that are hereby included as part of this section.
2. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, grounds, nailers, and blocking.

1.3 COORDINATION

A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For fiber-cement soffit including related accessories.

C. Samples for Verification: For each type, color, texture, and pattern required.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fiber-cement soffit.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement soffit.

C. Research/Evaluation Reports: For each type of fiber-cement soffit required, from ICC-ES.

D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of product, including related accessories, 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. Furnish full lengths of fiber-cement soffit including related accessories, in a quantity equal to 2 percent of amount installed.

1.9 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings and indicated as part of the integrated exterior mock-up.
2. Build mockups for fiber-cement soffit including accessories.
    a. Size: 48 inches long by 60 inches high.
    b. Include outside corner on one end of mockup and inside corner on other end.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store materials on elevated platforms, under cover, and in a dry location.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Structural failures including cracking and deforming.
    b. Deterioration of materials beyond normal weathering.
2. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SOFFIT

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.

1. Basis-of-Design Manufacturer and Product: Subject to compliance with requirements, provide products by James Hardie Building Products, Inc.

a. Product: Vented Plus.

B. Nominal Thickness: Not less than 5/16 inch.

C. Pattern: 24-inch- wide sheets with smooth texture.

D. Ventilation: Provide perforated soffit panels where indicated on the drawings.

E. Factory Priming: Manufacturer's standard acrylic primer.

2.3 FIBER CEMENT TRIM

A. Fiber-Cement Trim: Trim made from fiber-cement board that does not contain an asbestos fibers; complies with ASTM C 1186, Type A, Grade II; as classified as non-combustible when tested according to ASTM E136; and has a flame.

1. Trim Boards:

a. Basis-of-Design Product: Subject to compliance with requirements, provide James Hardie, Inc.; Hardietrim NT3.
b. Thickness: 1-inch actual.
c. Width: Manufacturer's standard nominal widths, unless otherwise noted.
d. Finish: Smooth.
e. Factory Priming: Manufacturer’s standard acrylic primer.

B. Factory Priming: Manufacturer’s standard acrylic primer.

2.4 ACCESSORIES

A. Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

1. Provide accessories matching color and texture of adjacent soffit unless otherwise indicated.

B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:

1. Moldings and trim.

C. Flashing: Provide aluminum flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

1. Finish for Aluminum Flashing: High-performance organic finish.

D. Fasteners:

1. For fastening to wood, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1 inch into substrate.
2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
3. For fastening fiber cement, use hot-dip galvanized fasteners.

E. Furring Strips for Battens:

1. Furring Strips: Galvanized steel, as per ASTM G-90, in manufacturer’s standard lengths.
   a. Basis of Design Manufacturer and Product: Furring-Master; Product 3/8” 22 gauge.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement soffit and related accessories.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.
2. Install fasteners no more than 24 inches o.c. or as recommended in manufacturers written instructions.

B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074646

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) 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 thermoplastic polyolefin (TPO) roofing system.
2. Preparation of roofing substrates.
3. Wood nailers for roofing attachment.
4. Roof insulation.
5. Cover board.
6. Metal roof edging and copings.
7. Flashings.
8. Walkway pads.
9. Other roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck 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. Pre-installation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck 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.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.
2. Where UL or FM requirements are specified, provide documentation that shows that the roofing system to be installed is UL-Classified or FM-approved, as applicable; include data itemizing the components of the classified or approved system.
    a. For specific code approvals achieved with this system, refer to Carlisle's Sure-Weld Code Approval Guide, DORA (Directory of Roof Assemblies), FM Approvals or UL Fire Resistance Directory for Roofing Materials and Systems.
3. Installation Instructions: Provide manufacturer's instructions to installer, marked up to show exactly how all components will be installed; where instructions allow installation options, clearly indicate which option will be used.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Layout and thickness of insulation.
3. Tapered insulation, including slopes.
4. Flashing details at penetrations.
5. Roof plan showing orientation of concrete roof deck and orientation of roofing, fastening spacings, and patterns for fastening roofing.
6. Insulation fastening or adhesive patterns for corner, perimeter, and field-of-roof locations.
7. Shop drawings must be submitted to Carlisle by the Carlisle Authorized Roofing Applicator along with a completely executed Notice of Award (Page 1 of Carlisle's Request For Warranty form) for approval. Approved shop drawings are required for inspection of the roof and on projects where on-site technical assistance is requested.

C. Samples for Verification: For the following products:

1. Sheet roofing, of color required.
2. Roof paver in each color and texture required.
3. Walkway pads or rolls, of color required.

D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of compliance with performance requirements.

C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.

D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

E. Field quality-control reports.

F. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 GENERAL DESIGN CONSIDERATIONS

A. It is the responsibility of the building owner or his/her designated representative to verify structural load limitation. In addition, a core cut may be taken to verify weight of existing components when the roofing system is to be specified on an existing facility.

B. On new construction projects, especially in cold climate regions, moisture generated due to the construction process could adversely impact various components within the roofing assembly if not addressed. (Refer to Spec Supplement G-01-18 “Construction Generated Moisture” included in the Carlisle Technical Manual).

C. On structural concrete decks, when a vapor retarder is not used, gaps in the deck along the perimeter and around penetrations must be sealed along with vertical joints between tilt-up panels, if present, to prevent infiltration of hot humid air and possible moisture contamination resulting from condensation. This is specifically important when adhesive is used to attach the roof insulation

D. Comply with Florida Building Code Product Approval or Miami-Dade NOA.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project. The specified roofing system must be installed by a Carlisle Authorized Roofing Applicator in compliance with drawings and specifications as approved by Carlisle SynTec.

1. Upon request, an inspection shall be conducted by a Field Service Representative of Carlisle to ascertain that the membrane roofing system has been installed according to Carlisle’s published specifications and details applicable at the time of bid. This inspection is to determine whether a warranty shall be issued. It is not intended as a final inspection for the benefit of the owner.

B. Installer Qualifications: 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.

1. Store Sure-Weld membrane in original undisturbed plastic wrap.

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. Job site storage temperatures in excess of 90□ F may affect shelf life of curable materials (i.e., adhesives and sealants).
2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. When liquid adhesives and sealants are exposed to lower temperatures, restore to a minimum of 60□ F before use.

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. Refer to Carlisle Technical Manual for applicable project specific Job Conditions.

1.12 WARRANTY

A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.

B. System Warranty: Manufacturer's standard warranty covering membrane, roof insulation, and membrane accessories.

1. Warranty Term: 20 year no-dollar-limit (NDL).
2. Scope of Coverage: Repair leaks in the roofing system caused by:

a. Ordinary wear and tear of the elements.
b. Manufacturing defect in Carlisle brand materials.
c. Defective workmanship used to install these materials.
d. Damage due to winds up to 90.

C. Special Project Warranty: Submit roofing Installer's warranty, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, rigid board insulation, fasteners, cover boards, adhesives, vapor retarders, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Manufacturer: Carlisle SureWeld TPO.

2.2 TPO MEMBRANE MATERIALS

A. Membrane: Sure-Weld white 60-mil thick reinforced Thermoplastic Polyolefin (TPO) membrane is used for this system. Field membrane sheets are 12', 10' or 8' wide by 100' long based on project conditions. Perimeter sheets are 6' wide (used with 12' or 10'field sheets), or 4' wide (used with 8' field sheets.

2.3 RELATED MATERIALS

A. Sure-Weld Non-Reinforced or Reinforced Flashing, Standard and Low-VOC Bonding Adhesive, Pressure Sensitive Cover Strip, TPO Pressure Sensitive R.U.S.S., TPO T-Joint Covers, Cut Edge Sealant, Water Cut-Off Mastic, Universal Single Ply Sealant, Weathered Membrane

Cleaner, Standard and Low-VOC Primers, One Part Pourable Sealer, Pre Molded Accessories, Heat Weldable Walkway Rolls and LIQUISEAL Liquid Flashing

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: Rigid cellular foam, as recommended and approved by the roofing manufacturer and shall meet the requirements of Florida Building Code Product Approval and FMG RoofNav requirements, complying with ASTM C 1289, Type II, Class 1, Grade 3, felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Carlisle.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated as per manufacturers written recommendations.

2.5 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

2.6 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions of Florida Building Code Product Approval and in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Carlisle SecurShield HD.

2.7 ACCESSORY MATERIALS

A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.

1. Width: 3-1/2 inches, nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
2. Thickness: Same as thickness of roof insulation.

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 minimum concrete drying period recommended by roofing system manufacturer has passed.
4. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
5. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.

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 after performing tests.
2. Refer to Carlisle Technical Manual for acceptable decks and the applicable Carlisle Fasteners.

D. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

E. On retrofit-recover projects, cut and remove wet insulation as identified by the specifier and fill all voids with new insulation, so that it is relatively flush.

3.3 INSTALLATION OF ROOFING, GENERAL

A. When feasible, begin the application at the highest point of the highest roof level and work to the lowest point to prevent moisture infiltration and minimize construction traffic on completed sections. This will include completion of all flashings and terminations.

B. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav, SPRI's Directory of Roof Assemblies listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.

D. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

E. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 072726 "Fluid-Applied Membrane Air Barriers.

3.4 INSTALLATION OF SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.
    a. Locate end joints over crests of steel roof deck.
2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

B. Loosely lay substrate board over roof deck

3.5 VAPOR BARRIER INSTALLATION

A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches, respectively.

1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
2. Seal laps by rolling.

3.6 INSULATION INSTALLATION

A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.

1. Carlisle Flexible FAST Adhesive may be specified for insulation securement in full spray or beads with spacing as outlined in the Carlisle Technical Manual.
2. Carlisle Fasteners may be used, when specified, to secure Carlisle Insulation at the specified density outlined in the Carlisle Technical Manual.

3.7 SINGLE-PLY MEMBRANE INSTALLATION

A. Sweep loose debris from the substrate.

B. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions

C. Position Sure-Weld Membrane over acceptable substrate and fold membrane back so half the underside is exposed.

D. Apply the applicable Carlisle Bonding Adhesive to the exposed underside of the membrane and the corresponding substrate area with a plastic core medium nap paint roller at the published application rate on the applicable Product Data Sheet.

E. Allow adhesive to dry until tacky and roll coated membrane into coated substrate and avoid wrinkling.

F. Brush down the bonded section of membrane immediately with a soft bristle push broom.

G. Fold back the un-bonded half of the sheet and repeat the bonding procedure.

H. Install adjoining membrane sheets in the same manner, overlapping edges a minimum of 2" to provide for a minimum 1- 1/2" hot air weld. It is recommended that all splices be shingled to avoid bucking of water.

I. Hot air weld the membrane sheets a minimum of 1-1/2” with an Automatic Hot Air Welding Machine.

J. Membrane that has been exposed to the elements for approximately 7 days must be prepared with Weathered Membrane Cleaner. Wipe the surface where Weathered Membrane Cleaner has been applied with a clean, dry HP Splice Wipe or other white rag to remove cleaner residue prior to hot air welding.

K. The membrane must be secured at the perimeter of each roof level, roof section, expansion joint, curb, skylight, interior wall, penthouse, etc., at any angle change which exceeds 2" per horizontal foot and at all other penetrations in accordance with Carlisle’s published details.

3.8 MEMBRANE FLASHING

A. Flash all walls and curbs with Sure-Weld reinforced membrane. Non-Reinforced membrane shall be limited to inside and outside corners, field fabricated pipe seals, scuppers and Sealant Pockets where the use of pre-molded accessories are not practical. Terminate the flashing in accordance with an appropriate Carlisle Termination Detail.

B. On vertical surfaces, such as walls, curbs and pipes, Bonding Adhesive is not required when flashing height is 12" or less and membrane is terminated under a metal counterflashing (nailed). When a coping or termination bar is used for vertical terminations, Bonding Adhesive may be eliminated for flashing heights 18" or less.

3.9 FLASHING AND ACCESSORIES INSTALLATION

A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.

1. Flash all walls and curbs with Sure-Weld reinforced membrane. Non-Reinforced membrane shall be limited to inside and outside corners, field fabricated pipe seals, scuppers and Sealant Pockets where the use of pre-molded accessories are not practical. Terminate the flashing in accordance with an appropriate Carlisle Termination Detail.

B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.

1. Follow roofing manufacturer's instructions.
2. Remove protective plastic surface film immediately before installation.
3. Install water block sealant under the membrane anchorage leg.
4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.

C. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.

D. Roofing Expansion Joints: Install as shown on drawings and as recommended by roofing manufacturer.

E. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches high above membrane surface.

1. Use the longest practical flashing pieces.
2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
4. Provide termination directly to the vertical substrate as shown on roof drawings.

F. Roof Drains:

1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.

2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch (12 to 19 mm) of membrane to extend inside clamping ring past drain bolts.
3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
4. Apply sealant on top of drain bowl where clamping ring seats below the membrane.
5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.

G. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.

1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches deep, with at least 1 inch clearance from penetration, sloped to shed water.
3. Structural Steel Tubing: If corner radii are greater than 1/4 inch and longest side of tube does not exceed 12 inches, flash as for pipes; otherwise, provide a standard curb with flashing.
4. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.

3.10 FINISHING AND WALKWAY INSTALLATION

A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.

B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1.0 inch and maximum of 3.0 inches from each other to allow for drainage.

1. If installation of walkway pads over field fabricated splices or within 6 inches of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches on either side.
2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

3.11 FIELD QUALITY CONTROL

A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes.

B. Perform all corrections necessary for issuance of warranty.

3.12 CLEANING

A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.

B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.

C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.13 PROTECTION

A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION 075423

SECTION 076200 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Formed Products:

a. Formed roof drainage sheet metal fabrications.
b. Formed wall sheet metal fabrications.
c. Formed steep-slope roof sheet metal fabrications.

B. Related Sections:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 077100 "Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations and keyed details. Distinguish between shop- and field-assembled work. Include the following:

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, and counterflashings as applicable.
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 flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

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. Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified fabricator.

B. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

C. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.6 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. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which 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 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated 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" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

E. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

F. Recycled Content of Steel-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 SHEET METALS

A. Aluminum Sheet: ASTM B 209, (ASTM B 209M) alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required, with smooth flat finish.

1. Exposed Coil-Coated Finishes:

a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604.

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.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed, with smooth surface.

1. Finish: No. 2D (dull, cold rolled).

C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Surface: Smooth, flat.
2. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: 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.

1. General: Blind fasteners or self-drilling screws, gasketed with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to the greatest extent possible.

1. 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.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

B. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

D. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

E. Seams: Fabricate non-moving seams with flat-lock seams. Form seals and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

F. Do not use graphite pencils to mark metal surfaces.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.

1. Gutter Style: K-Style gutters to match existing.
2. Expansion Joints: Butt type.
3. Hangers:
    a. Basis-of-Design Product: Subject to compliance with requirements provide Amerimax K-style Snap Lok Brackets for K-Style gutters.
4. Gutters with Girth up to 15 Inches: Fabricate from the following material:
    a. Aluminum: 0.0320 inch thick.
5. Gutters with Girth 16 to 20 Inches: Fabricate from the following material:
    a. Aluminum: 0.040 inch thick.

B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Fabricate downspouts from the following material:

a. Aluminum: 0.024 inch thick.

C. Parapet Scuppers: Fabricate scuppers of 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 with field of roof.

1. Fabricate parapet scuppers from the following material:

a. Stainless Steel: 0.0187 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 from the following material:

1. Stainless Steel: 0.019 inch thick.

2.6 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following material:

1. Aluminum: 0.0320 inch thick.

B. Drip Edges: Fabricate from the following material:

1. Aluminum: 0.0320 inch thick.
2. Color: Color at storefront and windows shall match storefront and window finish.

C. Eave and Rake Flashing: Fabricate from the following material:

1. Aluminum: 0.0320 inch thick.
2. Color: Color at exposed tile roof flashing shall match roof tile finish.

2.7 WALL SHEET METAL FABRICATIONS

A. Openings Flashing in Frame Construction: Fabricate head, sill, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch high end dams. Fabricate from the following material:

1. Aluminum: 0.032 inch thick.
2. Stainless Steel: 0.0187 inch thick where indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

D. Fasteners: Use fasteners of sizes that will penetrate through cementitious trim into cold formed metal framing not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.

F. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

G. Rivets: Rivet joints where indicated and where necessary for strength.

3.4 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored hangers spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter brackets in accordance with requirements and bracket manufacturer's written instructions.
2. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints.

1. Provide fasteners designed to hold downspouts securely to walls. Locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
2. Connect downspouts to underground drainage system indicated.

D. Splash Pans: Install where downspouts discharge on low-slope in elastomeric sealant compatible with roof membrane.

3.5 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Counterflashing: Coordinate installation of stainless steel counterflashing with installation of stainless steel base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.

1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

3.6 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall opening components such as windows, doors and louvers.

3.7 ERECTION 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.

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a 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.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

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. Section includes:

1. Copings.
2. Counterflashings and reglets.

B. Related Sections include the following:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
3. Section 079200 "Joint Sealants" for field-applied sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failing, rattling, leaking, and fastener disengagement due to defective manufacture, fabrication, installation or to other defects in construction.

B. FM Approvals' Listing: Manufacture and install copings that are listed in FM Approvals' "Roof Nav" and approved for Windstorm Classification, Class 1-90. Identify materials with FM Approvals'.

C. SPRI Wind Design Standard: Manufacture and install copings tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Provide manufactured roof specialties that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Water Infiltration: Provide manufactured roof specialties that do not allow water infiltration to building interior.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties include plans, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant and field assembled work. Include the following:

1. Details for fastening, joining, supporting, and anchoring manufactured roof specialties including fasteners, clips, cleats, and attachments to adjoining work.
2. Details for expansion and contraction.
3. Details of termination points and assemblies, including fixed points.
4. Details of special conditions.

C. Samples for Initial Selection: For each type of manufactured roof specialty indicated with factory-applied color finishes.

D. Samples for Verification: For copings and counterflashings made from 12-inch lengths of full-size components including roof-edge drainage systems, fasteners, cover joints, accessories and attachments.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, verifying compliance of copings with performance requirements.

B. Warranty: Sample of special warranty.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.7 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace manufactured roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
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 MATERIALS

A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for use and finish indicated, finished as follows:

1. Surface: Smooth, flat finish.
2. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer System: AAMA 620 System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight.

B. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation.

C. Aluminum Extrusions: ASTM B221 (ASTM B221M), alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

E. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.

1. Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 COPINGS

A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage, concealed splice plates with same finish as coping caps, mitered corner units, and end cap units.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hickman Edge Systems; Permasnap® or a comparable product by one of the following:

   a. Metal-Era, Inc.
   b. Perimeter Systems, a division of Southern Aluminum Finishing Co.
   c. Petersen Aluminum Corp.

2. Coping Cap Material: Formed aluminum 0.050 inch thick minimum or as required to meet performance requirements.

   a. Finish: Two-coat fluoropolymer.
   b. Color: As selected by Architect from manufacturer's full range.

3. Corners: Factory mitered and continuously welded.
4. Coping-Cap Attachment Method: Snap-on.
5. Snap-on Coping Anchor Plates: Concealed, galvanized steel sheet, 12 inches wide, with integral cleats.

B. Coping Expansion Joint (Roof-to-Roof): Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage, concealed splice plates with same finish as coping caps, mitered corner units, and end cap units.

1. Basis-of-Design Manufacturer and Product: Subject to compliance with requirements, provide products by the following:

   a. Metal-Era, Inc.

   b. Product: Perma-Tite Roof-to-Roof Expansion Joint.

2. Expansion Joint Material: Formed aluminum 0.040 inch thick minimum aluminum or as required to meet performance requirements.

   a. Finish: Three-coat fluoropolymer.
   b. Color: As selected by Architect from manufacturer's full range.

3. Formed Metal Cover Attachment Method: Snap-on.

2.4 COUNTERFLASHINGS

A. Counterflashings: Manufactured units in lengths not exceeding 12 feet designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal in thickness indicated.

1. Stainless Steel: 0.0250 inch thick.

B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashings indicated, from the following exposed metal in thickness indicated:

1. Stainless Steel: 0.0250 inch thick minimum.
2. Type: For metal wall panel application with upturned fastening flange and extension leg of length to match thickness of metal wall panel.

C. Accessories:

1. Counterflashing Wind-Resistant Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

D. Finish: No. 2D (dull, cold rolled).

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: 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.

D. Coil-Coated Aluminum Sheet Finishes:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.

B. Examine parapets for suitable conditions for manufactured roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor manufactured roof specialties securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.

1. Install roof specialties level, plumb, true to line and elevation, with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of sealant.
3. Install roof specialties to fit substrates and to result in watertight performance.
4. Torch cutting of manufactured roof specialties is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum manufactured roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing exposed-to-view components of manufactured roof specialties directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Install manufactured roof specialties level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks.

D. Install manufactured roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.

E. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

F. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

G. Seal joints with elastomeric sealant as required by manufacturer of roofing specialties.

H. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.3 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings to meet performance requirements:

1. Interlock face and back left drip edges into continuous cleats anchored to substrate at manufacturer’s recommended spacing.

3.4 COUNTERFLASHING AND REGLET INSTALLATION

A. General: Coordinate installation of counterflashings with installation of base flashings.

B. Counterflashings: Insert counterflashings in reglets or receivers and ensure that counterflashings overlap 4 inches over base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant.

1. Space movement joints at a maximum of 12 feet with no unplanned joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

C. Surface-Mounted Reglets: Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as manufactured roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 077129 - MANUFACTURED ROOF EXPANSION JOINTS

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. Bellows-type roof expansion joints.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wooden curbs or cants for mounting roof expansion joints.
2. Section 075323 "Thermoplastic Polyolefin (TPO) Roofing" for roofing system.
3. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-fabricated sheet metal expansion-joint systems, flashing, and other sheet metal items.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roof expansion joints.

1. Include plans, elevations, sections, and attachment details.
2. Include details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
3. Provide isometric drawings of intersections, terminations, and changes in joint direction or planes, depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.

C. Samples: For each exposed product and for each color specified, 6 inches in size.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each fire-barrier provided as part of a roof-expansion-joint assembly, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer of roofing membrane.

1.7 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise 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. General: Roof expansion joints shall withstand exposure to weather, remain watertight, and resist the movements indicated without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

C. Fire-Test-Response Characteristics: Provide fire-barrier assemblies with fire-test-response characteristics as determined by testing identical products, per test method indicated, by UL or another testing agency acceptable to authorities having jurisdiction. Assemblies shall be capable of anticipated movement while maintaining fire rating. Fire-barrier products shall bear classification marking of qualified testing agency.

1. Rating: Not less than fire-resistance rating of the roof assembly.

2.2 BELLOWS-TYPE ROOF EXPANSION JOINTS

A. Source Limitations: Obtain bellows-type roof expansion joints approved by roofing manufacturer and that are part of roofing membrane warranty.

B. Extruded Bellows Roof Expansion Joint: Manufactured, continuous, waterproof, joint-cover assembly, consisting of primary and secondary, single layered, elastomeric seals, and secured along each edge with extruded-aluminum retainers for fastening to substrate. Provide each size and type indicated, factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints, splicing units, adhesives,

and other components as recommended by roof-expansion-joint manufacturer for complete installation. Fabricate each assembly specifically for installation configuration indicated on Drawings.

1. Basis of Design Manufacturer:
    a. Johns Manville.
        (1) Product: Expand-o-flash.
2. Other Acceptable Manufacturers:
    a. CIS Group
    b. Michael Rizza Company.
    c. MM Systems Corporation.
3. Joint Movement Capability: Plus and minus 50 percent of joint size.

2.3 FLEXIBLE SHEET MATERIALS AND INSULATION

A. EPDM Membrane: Nonreinforced flexible Black EPDM conforming to ASTM D 4637, 60 mil thick.

B. Neoprene Membrane: Nonreinforced flexible, black neoprene, 60 mil thick.

C. Bellow Supports: Closed cell foam, minimum thickness of 3/8 in. for 4 in. bellow widths, 1/2 in for 6 in. and 8 in. bellow widths, 5/8 in. for 10 in. bellow widths and 3/4 in.12 in. bellow widths.

D. Insulation: Johns Manville Microlite® “L” specialty fiber glass insulation wrapped in 4 mil minimum thickness polyethylene sleeve and supported by continuous neoprene-coated nylon fabric vapor retarder.

2.4 MATERIALS

A. Stainless Steel: AISI Type 304, complying with ASTM A 167, 2D annealed finish, soft, except where harder temper is required for240/A 240M or ASTM A 666, Type 304.

B. Sheet Aluminum: ASTM B 209 (ASTM B 209M) alloy 3003-H14, mill finish; minimum 0.032 in. thick except as otherwise indicated.

C. Adhesives: As recommended by roof-expansion-joint manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.

1. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.

E. Mineral-Fiber Blanket: ASTM C 665.

2.5 MISCELLANEOUS ACCESSORIES

A. Termination Bar: 1 in. wide pre-punched extruded aluminum bar.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine roof-joint openings, inside surfaces of parapets, and expansion-control joint systems that interface with roof expansion joints, for suitable conditions where roof expansion joints will be installed.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for handling and installing roof expansion joints.

1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.
2. Install roof expansion joints true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
3. Provide for linear thermal expansion of roof expansion joint materials.
4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.
5. Provide uniform, neat seams.
6. Install roof expansion joints to fit substrates and to result in watertight performance.
7. Torch cutting of roof expansion joints is not permitted.
8. Do not use graphite pencils to mark aluminum surfaces.

B. Directional Changes and Other Expansion-Control Joint Systems: Coordinate installation of roof expansion joints with other expansion-control joint systems to result in watertight performance. Install factory-fabricated units at directional changes and at transitions between roof expansion joints and exterior expansion-control joint systems specified in Section 079500 "Expansion Control" to provide continuous, uninterrupted, and watertight joints.

C. Splices: Splice roof expansion joints with materials provided by roof-expansion-joint manufacturer for this purpose, to provide continuous, uninterrupted, and waterproof joints.

1. Install waterproof splices and prefabricated end dams to prevent leakage of secondary-seal membrane.

D. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

3.3 PROTECTION

A. Protect roof expansion joints from foot traffic, displacement, or other damage.

B. Remove and replace roof expansion joints and components that become damaged by moisture or otherwise.

END OF SECTION 077129

SECTION 077200 - ROOF ACCESSORIES

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. Section includes:

1. Roof curbs.
2. Equipment supports.
3. Pipe penetration system.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for ladders and miscellaneous metal framing and supports.
2. Section 061053 "Miscellaneous Rough Carpentry" for roof sheathing, wood cants, and wood nailers.
3. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, scuppers, gutters and downspouts, fasciae, roof expansion-joint covers, valleys, and miscellaneous sheet metal trim and accessories.
4. Section 077100 “Roof Specialties” for manufactured copings and counterflashing.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacturer, fabrication, installation, or other defects or construction.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, materials, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other Work. Indicate dimensions, loadings and special conditions. Distinguish between plant-and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on samples of size to adequately show color.

1.5 INFORMATIONAL SUBMITTALS

A. 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.

B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information on Shop Drawings of equipment to be supported.

1.8 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

A. Aluminum Sheet: ASTM B 209 manufacturer’s standard alloy for finish required, with temper to suit forming operations and performance required.

1. Mill Finish: As manufactured.

B. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M with G90 coating designation;

1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.

C. Aluminum Extrusions and Tubes: ASTM B221 (ASTM B221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

D. Stainless Steel Sheet and Shapes: ASTM A240/A240M or ASTM A666, Type 304.

E. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.

F. Steel Tube: ASTM A500/A500M, round tube.

G. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.

H. Steel Pipe: ASTM A53/A53M, galvanized.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Glass-Fiber Board Insulation: ASTM C 726, 1 inch thick unless otherwise indicated.

C. Polyisocyanurate Board Insulation: ASTM C 1289, 1 inch thick unless otherwise indicated.

D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C31; not less than 1-1/2 inches thick.

E. Fasteners: Roof accessory manufacturer’s recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

G. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 ROOF CURBS

A. Roof Curbs: Internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints and integral formed mounting flange. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Custom Curb, Inc.
    b. Pate Company (The)
    c. Roof Products & Systems Corporation.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Loads: Coordinate with load requirements of equipment supported.

D. Material: Zinc-coated (galvanized) steel sheet, 0.052-inch thick.
    a. Finish: Factory prime coating.

E. Construction:

1. Insulate curbs with 1-1/2-inch-thick, glass-fiber board insulation.
2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
3. Factory install wood nailers at tops of curbs.
4. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches, unless otherwise indicated, to comply with requirements.
5. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
6. Pipe Penetration Accessories: Manufacturer's standard thermoplastic curb cover with molded graduated elastomeric boots with stainless steel clamps to accommodate piping penetrations of varying sizes.

2.4 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Custom Curb, Inc.
    b. Pate Company (The)
    c. Roof Products & Systems Corporation.
2. Size: Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
3. Loads: Coordinate with load requirements of structure and equipment supported.

4. Material: Zinc-coated (galvanized) steel sheet, 0.052 inch thick.
    a. Finish: Factory prime coating.

B. Construction:

1. Factory-install continuous wood nailers 5-1/2 inches wide at tops of equipment supports.
2. Metal Counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.
3. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
4. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.5 PIPE PORTALS

A. Curb-Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless-steel snaplock swivel clamps.

B. Flashing Pipe Portal: Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless-steel snaplock swivel clamps.

2.6 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted metal collar.

1. Metal: Aluminum sheet, 0.063 inch thick.
2. Diameter: As indicated on Drawings.
3. Finish: Manufacturer's standard.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

1. Metal: Aluminum sheet, 0.063 inch thick.
2. Height: 7 inches.
3. Diameter: As indicated on Drawings.
4. Finish: Manufacturer's standard.

2.7 FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling or tool marks.

3.2 INSTALLATION

A. General:

1. Install roof accessories according to manufacturer's written instructions.
2. Anchor roof accessories securely in place and capable of withstanding resisting forces specified.
3. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessories installation 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 weathertight.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
2. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

C. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

D. Roof Curb Installation: Install each roof curb so top surface to roof curb is level.

E. Equipment Support Installation: Install equipment support so top surface of equipment support is level, with each other.

3.3 REPAIR AND CLEANING

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 9 painting Sections.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touch up or similar minor repair procedures.

END OF SECTION 077200

SECTION 077661 – ROOF PAVERS AND PEDESTALS

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. Roof pavers supported on pedestals.

B. Related Requirements:

1. Section 075423 "Thermoplastic Polyolefin Roofing" for roof membrane.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of roof pavers.

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins to adjoining waterproofing, and other termination conditions.

1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

C. Samples: For roof pavers and pedestals in each color and texture required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Materials shall be stored in a neat, safe manner, not to exceed the allowable structural capacity of the storage area.

C. Store materials in a clean, dry area protected from water and direct sunlight.

D. Store all adhesives at temperatures between 60°F (15.5°C) and 80°F (26.6°C). If exposed to lower temperatures, restore materials to 60°F (15.5°C) minimum temperature before using.

1.8 FIELD CONDITIONS

A. Application of the roof pavers and pedestals shall not commence nor proceed during inclement weather.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace roof pavers and pedestals that do not comply with requirements or that fail to remain watertight within specified warranty period.

1. Warranty includes removing and reinstalling pedestals and pedestal-mounted pavers on plaza decks.
2. Warranty pavers do not dish or warp and do not crack, split, or disintegrate in freeze-thaw conditions.
3. Warranty Period: 10 years from date of Substantial Completion.

B. Special Installer's Warranty: Specified form signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 ROOF PAVERS AND PEDESTALS

A. Plaza-Deck Pavers: Heavyweight, hydraulically pressed, concrete units, square edged, manufactured for use as plaza-deck pavers; minimum compressive strength 7500 psi, ASTM C 140; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Hanover Architectural Products; Guardian Pavers.

2. Thickness: 2 inches, nominal.
3. Compressive Strength: 5,000 psi minimum when tested according to ASTM C 140.
4. Face Size: As indicated on the Drawings.
5. Dynamic Coefficient of Friction: Provide products specified for installation on floors with the following values as determined by testing identical products with BOT 3000 testing device in accordance with provisions of ANSI A137.1 – 2012.

   a. Dynamic Coefficient of Friction (DCOF): Minimum 0.42.
   b. Exterior Roof Paver Areas Subject to Wet Conditions: DCOF 0.60, minimum.

6. Color: As selected by Architect from manufacturer's full range.

B. Paver Pedestals: Pedestal system consists of pedestals and caps, including “snap-fit” top and bottom shims and leveling plates, as required for adjustment and leveling of pavers; each pedestal tested to support at ultimate failure compression load of 11,500 psi , with maximum height of 22 inches.

1. Basis of Design Manufacturer: Tile Tech Pavers; Product Roof Pedestal System.
2. Top Cap: ½-inch high with 1/8-inch joint spacers; ABS plastic composed of Dow “ABS 70” plastic.
3. Bottom Cap: ½-inch high with smooth protective edges; ABS plastic composed of Dow “ABS 70” plastic.
4. Top and Bottom Shims: 1/8 and 1/16-inch thick, lock to top and bottom caps; ABS plastic composed of Dow ABS 70” plastic.
5. Spacers: 1-inch long x ½-inch high 1/8-inch thick used with bottom shim for heights lower than ½-inch; ABS plastic composed of Dow “ABS 70” plastic.
6. Buffer Pads: Thermoplastic Elastomer (TPE) “Kraton”, meeting minimum physical requirements of following tests:

   a. Tensile strength and elongation, break at 830psi, and elongation at break minimum of 270% per ASTM D 412.
   b. Tear resistance of 18psi, per ASTM D 624
   c. Shore Hardness (A Scale): 70.

7. Pedestal Pipe: 4-inch diameter PVC Schedule 80 pipe, type SDR 35 meeting ASTM D-3034 and F-679; provide pipe for use in the pedestal system

C. Protection Sheet: ASTM D 6506, semi-rigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners; 1/4-inch nominal thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine each area indicated to receive roof pavers for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Verify that perimeter and other flashings are in place and secure along entire lengths where they will be covered by roof pavers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Protect structures, utilities, sidewalks, pavements, and other facilities and areas from damage caused by installation.

B. Protection Sheet: Cover membrane roofing with protection sheet as per manufacturer's written instructions before membrane roofing is subject to roof paver assembly installation work.

3.3 ROOF PAVER INSTALLATION

A. General: Install walkway pavers in locations and of widths shown on Drawings and according to manufacturer's written instructions.

B. Accurately install adjustable-height paver pedestals and accessories to elevations required. Adjust for final level and slope with shims.

1. Fill paver pedestal with concrete mix, strike smooth with top of pedestal, and cure according to ACI 301.

C. Loosely lay pavers on pedestals, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.

1. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.

D. Install pavers to not vary more than 1/16 inch in elevation between adjacent pavers or more than 1/16 inch from surface plane elevation of individual paver.

E. Limit variation in paving installation to within 1/4 inch in 10 feet of surface plane in any direction; noncumulative.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage membrane roofing manufacturer's authorized service representative to provide inspection of roof membrane installation and prepare inspection reports.

B. Correct deficiencies in work that do not comply with requirements.

3.5 CLEANING AND PROTECTION

A. During installation, keep adjacent areas and construction clean and maintain work area in an orderly condition.

B. Protect roof pavers from damage due to operations of other contractors and trades. Replace damaged roof pavers.

END OF SECTION 077661

SECTION 078100 – APPLIED FIREPROOFING

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. Section includes sprayed fire-resistive materials.

1.3 DEFINITIONS

A. SFRM: Sprayed Fire Resistive Materials.

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: Framing plans, schedules, or both indicating the following:

1. Extent of fireproofing for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Product Certificates: For each type of fireproofing.

C. Compatibility and Adhesion Test Reports: From SFRM manufacturer indicating the following:

D. Evaluation Reports: For fireproofing, from ICC-ES.

E. Preconstruction Test Reports: For fireproofing.

F. Field Quality Control Reports.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by SFRM as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its SFRMs to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.

1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.9 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 is 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 SFRM. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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; testing 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. Sprayed Fire-Resistive Material: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and conveyed in a dry state and mixed with atomized water at place of application.

1. Products: Subject to compliance with requirements, provide the following:
    a. Isolatek International: Cafco Blaze-Shield II.
2. Bond Strength: Minimum 150-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. 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. Combustion Characteristics: ASTM E 136.
6. 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 or less.
    b. Smoke-Developed Index: 0 or less.
7. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 1,440 psf.
8. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
9. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
11. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
12. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21 or rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273.

2.3 AUXILIARY FIRE-RESISTIVE MATERIALS

A. General: Provide auxiliary fire-resistive materials that are compatible with SFRMs 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 E 736.
2. Primer is identical to those used in assemblies tested for fire-test-response characteristics of SFRM per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Bonding Agent: Product approved by sprayed fire-resistive material manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and sprayed fire-resistive material manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.

E. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.

F. Topcoat: Suitable for application over sprayed fire-resistive material; of type recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.

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 work. A substrate is in satisfactory condition if it complies with the following:

1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
2. Substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.

B. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of oil, rolling compounds, and other substances capable of interfering with bond.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.

B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, loose mill scale, and incompatible primers, paints, and encapsulants.

C. Prime substrates where recommended in writing by SFRM manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive SFRM.

D. For exposed applications, repair substrates to remove any surface imperfections that could affect uniformity of texture and thickness in finished surface of SFRM. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION, GENERAL

A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

B. Apply SFRM that is identical to products tested as specified in Part 1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.

C. Install metal lath, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by SFRM manufacturer. Attach lathing accessories where indicated or required for secure attachment to substrate.

D. Coat substrates with adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by SFRM manufacturer for material and application indicated.

E. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by SFRM manufacturer, install body of fire-resistive covering in a single course.

F. Spray apply fire-resistive materials 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 SFRM manufacturer.

3.4 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 mixing materials, application procedures, and types of equipment used to mix, convey, and 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. Metal Decks:

1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, is completed.

2. Do not apply fireproofing to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fireproofing.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. Extend fireproofing in full thickness over entire area of each substrate to be protected.

H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

I. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

J. Cure fireproofing according to fireproofing manufacturer's written instructions.

K. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Test and inspect as required by the IBC, Subsection 1705.13 “Sprayed Fire-Resistant Materials”.

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 sufficient thickness, and retest.

D. Prepare test and inspection reports.

3.6 CLEANING, PROTECTING, AND REPAIR

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 SFRM, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Substantial Completion.

C. Coordinate application of SFRM with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect SFRM and patch any damaged or removed areas.

D. Repair or replace work that has not been successfully protected.

END OF SECTION 078100

SECTION 078413 - PENETRATION FIRESTOPPING

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. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

B. Related Sections:

1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, and in smoke barriers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Engineering Judgements: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. The contractor shall use ancillary building products (including, but not limited to fire stops, thread sealants, leak detectors, etc.) that are chemically compatible with Lubrizol CPVC compounds where specified.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
    a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
    b. Classification markings on penetration firestopping correspond to designations listed by the following:
        1) UL in its "Fire Resistance Directory."
        2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
        3) FM Global in its "Building Materials Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetrating Firestopping Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hilti, Inc.
2. 3M Fire Protection Products.
3. Specified Technologies Inc. (STI)

C. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

D. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

E. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:
    a. Slag-wool-fiber or 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. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial

extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure 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. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

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: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping 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 of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. 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 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 penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping 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 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 and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping 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 the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

D. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. 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 – Penetration Firestopping – Do Not Disturb, Notify Building Management of any Damage.”.
2. Contractor’s name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer’s name.
6. Installer’s name.

3.4 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 078443 - JOINT FIRESTOPPING

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. Section includes:

1. Joints in or between fire-resistance-rated construction.
2. Joints in smoke barriers.

B. Related Sections include the following:

1. Section 078413 “Penetration Firestopping” for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1. Where Project conditions require modification to a qualified testing agency’s illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer’s fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Installer Certificates: From Installer indicating fire resistive joint systems have been installed in compliance with requirements and manufacturer’s written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for fire-resistive joint systems.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer’s written instructions using natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Fire-resistance 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 fire-resistive joint systems acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
    a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
    b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

2.2 JOINT FIRESTOPPING

A. Joint Firestopping Systems: Systems that resist spread of fire, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint 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 fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hilti, Inc.
b. 3M Fire Protection Products.
c. Specified Technologies Inc. (STI).
d. Tremco, Inc.

2. 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. Manufacturers: Subject to compliance with requirements provide products by one of the following:

a. Hilti, Inc.
b. 3M Fire Protection Products.
c. Specified Technologies Inc. (STI).
d. Tremco, Inc.

2. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.

D. Exposed Fire-Resistive Joint Systems: Provide products with 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 fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems 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 work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems 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 fill materials.

2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. 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 fire-resistive joint 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 Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
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. Inspecting Agency: Owner will engage a qualified independent inspecting agency to perform tests and inspections.

B. Were deficiencies are found or fire-resistive joints systems are damaged or removed due to testing, repair or replace fire-resistive joints systems so they comply with requirements.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint 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 fire-resistive joint 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.

3.6 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN.

B. Where Intertek ETL SEMKO-listed systems are indicated, they refer to design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under product category Expansion/Seismic Joints or Firestop Systems.

C. Head-of-Wall, Joint Firestopping Systems:

1. UL-Classified Systems: HW-D 0000-0999.
2. Integrity Rating: 1 hour, unless otherwise required to meet or exceed fire resistance rating of wall.
3. Nominal Joint Width: As indicated.
4. Movement Capabilities: Class II.

D. Perimeter Joint Firestopping Systems:

1. UL-Classified Perimeter Fire-Containment Systems: CW-D 0000-0999.
2. Integrity Rating: 1 hour, unless otherwise required to meet or exceed fire resistance rating of wall or floor.
3. Movement Capabilities: Class II.

END OF SECTION 078443

SECTION 079200 - JOINT SEALANTS

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. Section includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Silyl-terminated polyether joint sealants.
4. Latex joint sealants.
5. Butyl joint sealants.
6. Preformed joint sealants.

B. Related Sections:

1. Section 079500 “Expansion Control” for building expansion joints.
2. Section 078443 “Joint Firestopping” for sealing joints in fire-resistance-rated construction.
3. Section 088000 “Glazing” for glazing sealants.
4. Section 093013 “Ceramic Tiling” for sealing tile joints.
5. Section 095113 “Acoustical Panel Ceilings” for sealing edge moldings of perimeters with acoustical sealants.

1.3 PRECONSTRUCTION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION 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. Samples for Verification: For each type and color of joint sealant required, provide samples with joint sealants in 1/2-wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.

3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

C. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

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.

F. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:
    a. Each kind of sealant and joint substrate indicated.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.8 PROJECT CONDITIONS

A. 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 or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Manufacturer's Warranty: Provide Manufacturer's standard warranty as indicated in the body of this specification section in which sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, 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. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer’s full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide Dow Corning Corporation; Dowsil 795.

a. Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that demonstrate deterioration or failure under normal use within warranty period specified. Provide manufacturer’s standard material warranty of twenty (20) years beginning at the date of Substantial Completion.

B. Silicone, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Products: Subject to compliance with requirements, provide Dow Corning Corporation; Dowsil 790.

a. Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that demonstrate deterioration or failure under normal use within warranty period specified. Provide manufacturer's standard material warranty of twenty (20) years beginning at the date of Substantial Completion.

2.3 URETHANE SEALANTS

A. Urethane S, P, 25, T, NT: Single component, pourable, plus 25 percent and minus 25 percent movement capability, traffic and non-traffic, urethane joint sealant, ASTM C 920, Type S, Grade P, Class 25, uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. BASF Construction Chemicals LLC; Building Systems; MasterSeal SL1.
      1) Warranty: Provide manufacturer's standard material warranty of five (5) years beginning at the date of Substantial Completion.
   b. Pecora Corporation: NR-201.
      1) Warranty: Provide manufacturer's standard material warranty of five (5) years beginning at the date of Substantial Completion.

2.4 SILYL-TERMINATED POLYETHER (STPE) JOINT SEALANTS

A. STPE, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide the following:
   a. BASF Construction Chemicals LLC, Building Systems: MasterSeal NP 150.
      1) Warranty: Provide manufacturer's standard material warranty of five (5) years beginning at the date of Substantial Completion.
      2) Include coverage for replacement of sealant materials which fail to achieve water tight seal, exhibit loss of adhesion or cohesion, or do not cure, provided sealant has been installed per manufacturer's recommendation.
      3) Warranty Exclusions: Failure resulting from concrete shrinkage, excessive movement structural cracks or defects, faulty construction, faulty design, faulty materials (other than joint sealants), improper installation, misuse of structure, settlement, or accident, fire, or other casualty or physical damage.

2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant, Single-Component Mildew-Resistant Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Dow Corning Corporation; Dowsil 786 Mildew Resistant.
      1) Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that demonstrate

deterioration or failure under normal use within warranty period specified. Provide manufacturer's standard material warranty of twenty (20) years beginning at the date of Substantial Completion.

b. GE Advanced Materials-Silicones; Sanitary SCS1700.

1) Warranty: Provide manufacturer's standard material warranty of ten (10) years beginning at the date of Substantial Completion

c. Tremco Incorporated; Tremsil 200 Clear.

1) Warranty: Provide manufacturer's standard material warranty of five (5) years beginning at the date of Substantial Completion.

2.6 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Tremco Incorporated, Tremflex 834.

1) Warranty: Provide manufacturer's standard material warranty of five (5) years beginning at the date of Substantial Completion.

2.7 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealant: ASTM C 1311.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bostik, Inc.; Chem-Calk 300.

1) Limited Warranty: The Manufactruer warrants its product to be free of defects. The sole remedy for noncompliance of this product shall be the replacement of the product or refund the purchase price.

b. Pecora Corporation; BC-158.

1) The Manufacturer warrants its products to be free of defects. Under this warranty, we will provide, at no charge, replacement materials for, or refund the purchase price of, any product proven to be defective when used in strict accordance with our published recommendations and in applications considered by us as suitable for this product. The determination of eligibility for this warranty, or the choice of remedy avail- able under this warranty, shall be made in our sole discretion and any decisions made by Pecora Corporation shall be final. This warranty is in lieu of any and all other warranties, expressed or implied, including but not limited to a warranty of merchantability or fitness for a particular purpose and in no case will Pecora be liable for damages other than those expressly stated in this warranty, including but not limited to incidental or consequential damages.

2.8 PREFORMED JOINT SEALANTS

A. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant that is manufactured from high-density urethane foam impregnated with a

nondrying, water-repellent agent; is factory produced in precompressed sizes in roll or stick form to fit joint widths indicated; is coated on one side with a pressure-sensitive adhesive and covered with protective wrapping; develops a watertight and airtight seal when compressed to the degree specified by manufacturer.

1. Products: Subject to compliance with requirements, provide the following:
    a. EMSEAL Joint Systems Ltd; Emseal 25V.
        1) Warranty: Provide manufacturer's standard material warranty of five (5) years beginning at the date of Substantial Completion.

2.9 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. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

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.

2.10 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 to 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.

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 and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. 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.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. 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.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. 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 sealant from surfaces adjacent to joints.
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.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.

I. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

a. Whether sealants filled joint cavities and are free of voids.
b. Whether sealant dimensions and configurations comply with specified requirements.
c. 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 kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. 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.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion 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 sealant 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 original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces JS-1.

1. Joint Locations:

    a. Isolation and contraction joints in cast-in-place concrete slabs.
    b. Other joints as indicated.

2. Urethane Joint Sealant: Multicomponent, nonsag, traffic grade, Class 25 (BASF MasterSeal SL1).
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces JS-2.

1. Joint Locations:

    a. Construction joints in cast-in-place concrete.
    b. Control and expansion joints in unit masonry.
    c. Joints between frames of storefront systems, windows and louvers and masonry and stucco systems.
    d. Joints between different materials listed above including stucco to stucco joints.
    e. Other joints as indicated.

2. Joint Sealant: Silicone, non-staining, S, NS, 100/50, NT (Dow 790).
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Exterior joints in vertical surfaces JS-3.

1. Joint Locations:

    a. Joints in exterior stucco systems.
    b. Perimeter joints between frames of doors, storefront systems, windows and louvers and other materials including ACM panel systems.
    c. Joints between metal panels.
    d. Other joints as indicated.

2. Joint Sealant: Silicone, non-staining, S, NS, 50, NT (Dow 795).
3. Joint Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces JS-4.

1. Joint Locations:

    a. Joints in fiber cement siding and trim.
    b. Other joints as indicated.

2. Joint Sealant: STPE, S, NS 100/50 NT (BASF MasterSeal NP 150).
3. Joint Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in horizontal traffic surfaces JS-5.

1. Joint Locations:

    a. Isolation joints in cast-in-place concrete slabs.
    b. Other joints as indicated.

2. Urethane Joint Sealant: Multicomponent, nonsag, traffic grade, Class 25 (MasterSeal SL1).
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces JS-6.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings where indicated.
c. Vertical joints on exposed surfaces of interior unit masonry, concrete, walls and partitions.
d. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
e. Other joints as indicated.

2. Joint Sealant: Latex Acrylic based (Tremflex 834).
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces JS-7.

1. Joint Sealant Location:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Other joints as indicated.

2. Joint Sealant: Single component, nonsag, mildew resistant, acid curing silicone (Dow 786 Mildew Resistant).
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 079500 - EXPANSION 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:

1. Exterior roof and wall expansion control systems.

B. Related Requirements:

1. Section 077129 "Manufactured Roof Expansion Joints" for factory-fabricated roof expansion control.
2. Section 079200 "Joint Sealants" for liquid-applied joint sealants and for elastomeric sealants without metal frames.

1.3 ACTION SUBMITTALS

A. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blackout 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.

B. Samples: For each exposed expansion control system and for each color and texture specified, full width by 6 inches long in size.

C. Samples for Initial Selection: For each type of expansion control system indicated.

1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

D. Samples for Verification: For each type of expansion control system indicated, full width by 6 inches long in size.

E. Product Schedule: Prepared by or under the supervision of the supplier. 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.

6. Fire-resistance ratings.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire barrier provided as part of an expansion control system, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 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 elsewhere.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Where indicated, provide expansion control systems with fire barriers identical to those of systems tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.

2.3 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated.

B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

C. Wall-to-Wall:

1. Basis-of-Design Manufacturer: Emseal.
   a. Model WFR.
2. Product Characteristics:
   a. Nominal Joint Width: 2-inch.

b. Description: Silicone coated, ultraviolet resistant, dual-faced, fire-rated, watertight primary wall seal.
c. Movement capability: Plus and minus 50% (total 100%) of nominal material size.
d. Silicone: Field applied corner bead at face of seal to substrate interface, furnished by joint seal manufacturer, in same material and color as used in factory coating.

a. Abrasion Resistance: Less than 1% weight loss, tested to ASTM D4060.
b. Fuel Resistance: Pass, tested to ASTM C719/C1135.

e. Adhesive: Epoxy type, furnished by joint seal manufacturer.
f. Movement capability: Plus and minus 50% (total 100%) of nominal material size.
g. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.

3. Type: Surface mounted system.

a. Color: As selected by Architect from manufacturer's full range.

D. Roof-to-Wall:

1. Basis-of-Design Manufacturer: Emseal.

a. Model Roof-Joint.

2. Product Characteristics:

a. Nominal Joint Width: 2-inch.
b. Material: Heat weldable, Nitrile PVC or TPV thermoplastic extrusion with dual-level flange.
c. Manufacturer supplied termination bar and anchors.
d. Factory welded downturn transition in the RoofJoint gland that is sealed at a ship lapped 45-degree angle to mate with an interlocking factory-fabricated RoofJoint/SEISMIC COLORSEAL transition piece.
e. Color: As selected by Architect from manufacturer's full range.

E. Wall Corner:

1. Basis-of-Design Manufacturer: Emseal.

a. Model WFR System.

2. Product Characteristics:

a. Nominal Joint Width: 2-inch.
b. Description: Silicone coated, ultraviolet resistant, dual-faced, fire-rated, watertight primary wall seal.
c. Movement capability: Plus and minus 50% (total 100%) of nominal material size.
d. Silicone: Field applied corner bead at face of seal to substrate interface, furnished by joint seal manufacturer, in same material and color as used in factory coating.

c. Abrasion Resistance: Less than 1% weight loss, tested to ASTM D4060.
d. Fuel Resistance: Pass, tested to ASTM C719/C1135.

e. Adhesive: Epoxy type, furnished by joint seal manufacturer.
f. Movement capability: Plus and minus 50% (total 100%) of nominal material size.
g. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.

3. Type: Surface mounted system.

1) Color: As selected by Architect from manufacturer's full range.

F. Wall-to-Soffit:

1. Basis-of-Design Manufacturer: Emseal.
   a. Model WFR System.
2. Product Characteristics:
   a. Nominal Joint Width: 2-inch.
   b. Description: Silicone coated, ultraviolet resistant, dual-faced, fire-rated, watertight primary wall seal.
   c. Movement capability: Plus and minus 50% (total 100%) of nominal material size.
   d. Silicone: Field applied corner bead at face of seal to substrate interface, furnished by joint seal manufacturer, in same material and color as used in factory coating.
   e. Abrasion Resistance: Less than 1% weight loss, tested to ASTM D4060.
   f. Fuel Resistance: Pass, tested to ASTM C719/C1135.
   e. Adhesive: Epoxy type, furnished by joint seal manufacturer.
   f. Movement capability: Plus and minus 50% (total 100%) of nominal material size.
   g. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
3. Type: Surface mounted system.
   1) Color: As selected by Architect from manufacturer's full range.

G. Soffit-to-Soffit:

1. Basis-of-Design Manufacturer: Emseal.
   a. Model WFR System.
2. Product Characteristics:
   a. Nominal Joint Width: 2-inch.
   b. Description: Silicone coated, ultraviolet resistant, dual-faced, fire-rated, watertight primary wall seal.
   c. Movement capability: Plus and minus 50% (total 100%) of nominal material size.
   d. Silicone: Field applied corner bead at face of seal to substrate interface, furnished by joint seal manufacturer, in same material and color as used in factory coating.
   g. Abrasion Resistance: Less than 1% weight loss, tested to ASTM D4060.
   h. Fuel Resistance: Pass, tested to ASTM C719/C1135.
   e. Adhesive: Epoxy type, furnished by joint seal manufacturer.
   f. Movement capability: Plus and minus 50% (total 100%) of nominal material size.
   g. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
3. Type: Surface mounted system.
   a. Color: As selected by Architect from manufacturer's full range.

2.4 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard moisture barrier consisting of a continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary cover.

2.5 MATERIALS

A. Elastomeric Seals: ASTM E 1783; preformed elastomeric membranes or extrusions to be installed in metal frames.

B. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.

C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required fire-resistance rating.

D. Moisture Barrier: Flexible elastomeric material, EPDM, minimum 45 mils thick.

E. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

F. 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.

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.

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. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion control system materials and associated work so complete assemblies comply with assembly performance requirements.

1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

C. Moisture Barrier: Provide at all exterior joints and where indicated on Drawings. Provide drainage fittings at a maximum of 50 feet or where indicated on Drawings.

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 079500

SECTION 079513.13 - INTERIOR 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. Section includes interior expansion joint cover assemblies.

1.3 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 expansion joint cover assemblies. Data to clearly indicate movement capability of cover assemblies and suitability of material used in exterior seal for UV exposure

B. Shop Drawings: Provide the following for each joint system specified and obtain approval prior to fabrication and shipment of materials to the job site:

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples: For each expansion joint cover assembly and for each color and texture specified, full width by 6 inches long in size.

D. Samples for Initial Selection: For each type of exposed finish.

1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric-seal material.

E. Samples for Verification: For each type of expansion joint cover assembly, full width by 6 inches long in size.

F. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:

1. Manufacturer and model number for each expansion joint cover assembly.
2. Expansion joint cover assembly location cross-referenced to Drawings.
3. Nominal, minimum, and maximum joint width.
4. Movement direction.
5. Materials, colors, and finishes.
6. Product options.

7. Fire-resistance ratings.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates – Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements indicated.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Approved by manufacturer and having experience installing joint systems that are similar in design complexity.

B. Source Limitations: Obtain all architectural joint systems through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of architectural joint systems and are based on the specific systems indicated.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Fire-Test-Response Characteristics: Where indicated, provide architectural joint system and fire-barrier assemblies identical to those of assemblies tested for fire resistance per UL 2079 and/or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction. Fire rating not less than the rating of adjacent construction

E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockup of typical expansion joint cover assembly as shown on Drawings.
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.

1.6 WARRANTY

A. Manufacturer’s standard Warranty: Manufacturer to provide 5 year warranty for all joint covers.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Expansion joint cover assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E 1966 by a qualified testing agency.

C. Expansion Joint Design Criteria:

1. Type of Movement: Thermal.
    a. Nominal Joint Width: As indicated on Drawings.
    b. Minimum Joint Width: As indicated on Drawings.
    c. Maximum Joint Width: As indicated on Drawings.
2. Type of Movement: Seismic.
    a. Joint Movement: As indicated on Drawings.

2.3 INTERIOR EXPANSION JOINT COVERS

A. Wall-to-Wall Joint Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    a. Construction Specialties, Inc.
    b. Product: Model FWF Series.
2. Type: Flat seal.
    a. Exposed Metal: Aluminum.
        1) Finish: Mill.
    b. Seal Material: Santoprene.
        1) Color: As selected by Architect from manufacturer's standard range.
3. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.

B. Ceiling-to -Ceiling Joint Systems at ACT:

1. Basis-of-Design Product: Construction Specialties, Inc. Model FCF-200.
2. Type: Flat seal.
    a. Exposed Metal: Aluminum.
        1) Finish: Mill.
    b. Seal Material: Santoprene.

1) Color: As selected by Architect from manufacturer's standard range.

C. Ceiling-to-Ceiling Joint Systems at GWB Ceilings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Construction Specialties, Inc.
   b. Product: Model FWF Series.
2. Type: Flat seal.
   a. Exposed Metal: Aluminum.
      1) Finish: Mill.
   b. Seal Material: Santoprene.
      1) Color: As selected by Architect from manufacturer's standard range.
      2) Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.

D. Floor-to-Floor Joint Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Construction Specialties, Inc.
   b. Product: Model APF Series.
2. Type: Cover plate.
   a. Exposed Metal: Aluminum.
      1) Finish: Mill.
   b. Cover Plate Design: Serrated/Striated.
   c. Attachment Method: Mechanical Anchors.
   d. Load Capacity: Heavy duty.
   e. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.
   f. Vapor Barrier: Manufactruer’s standard.
   g. Tamper Resistant: No exposed fasteners for tamper proof applications.

E. Floor-to-Floor Joint Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Inpro Architectural Products.
   b. Product: Model Fireline F140 Series (2 hour rated).
2. Type: Fire Rated Barriers and Blanket Systems.
   a. Product Characteristics:
      1) Pre-attached flanges and male/female seam configuration.
      2) Compression installation spring system for non-invasive installation.
      3) Prefabricated male/ female seam configuration required for consistent fire protection.
      4) No mechanical fastening or continuous fire caulk required.

b. Tested by Accredited Third Party Architectural Testing and Listing Agency in accordance with ASTM E814/119, E1966 and UL 2079 at its full rated period.
c. Moisture Barrier for vertical and horizontal applications: Reinforced EPDM 45 mil thick membrane with nylon mesh reinforcement. Optional drain fittings available in .375" and 1" inside diameter. On center spacing of drains to be determined by Plumbing Engineer of Record. Seams and directional transitions designed to ensure watertight seal and positive condensation drainage.
d. Insulated Thermal Moisture Barrier for Vertical and Horizontal Applications: Reinforced EPDM 45 mil thick membranes sandwiching commercial grade batt insulation adhered and pinned together to resist slump and cyclic movement (movement must match the capabilities of the specified coverplate systems) and shall maintain R-value equivalent to the exterior and roof assemblies on project. Seams and directional transitions designed to ensure watertight seal and positive condensation drainage.
e. Waterproof Foam Seals: Manufacturer's standard open cell silicone faced precompressed foam.

2.4 MATERIALS

A. Aluminum: ASTM B 221, Alloy 6063-T5, 6063-T6, 6063-T52, 6061-T5, 6061-T6, 6061-T51, 6105-T5, 6105-T6, 6005-T5, 6005A-T5, 6005A-T61 for extrusions; ASTM B 209, Alloy 6061-T6, 3003-H14, 5005-H34 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Stainless Steel: ASTM A 666, Type 304 for plates, sheet, and strips.

C. Brass: ASTM B 36/B 36M, UNS Alloy C26000 for half hard sheet and coil.

D. Bronze: ASTM B 455, Alloy C38500 for extrusions; Alloy C28000 Muntz Metal for plates.

E. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.

F. Compression Seals: ASTM D2000; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.

G. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.

H. Moisture Barrier: Manufacturer's standard, 7-ply laminate reinforced Polyethylene.

I. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

J. 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.

2.5 FINISHES, GENERAL

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.

2.6 ALUMINUM FINISHES

A. Mill Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

C. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.

D. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturers' written instructions.

2.7 STAINLESS STEEL FINISHES

A. Finish: No.4, directional satin.

1. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.8 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.

1. Provide where indicated on Drawings.

B. Manufacturer's standard attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.

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 joint installation and performance.
3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
4. Locate in continuous contact with adjacent surfaces.
5. Standard-Duty Systems: Shim to level where required. Support underside of frames continuously to prevent vertical deflection when in service.
6. Heavy-Duty Systems: Repair or grout blockout as required for continuous frame support and to bring frame to proper level. Shimming is not allowed.
7. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.
2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.

3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer before installing compression seals

E. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

F. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

G. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.

1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

H. Water Barrier: Provide water barrier at exterior joints and where called for on Drawings. Provide drainage fittings where indicated.

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 joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION 079513.13

SECTION 081113 – 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

B. Related Sections include the following:

1. Section 087100 "Door Hardware" for door hardware for hollow metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include construction details, material descriptions, core descriptions, fire resistance ratings and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.

6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.
10. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

1.6 NFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly, fire-rated borrowed-lite assemblies, windborne-debris impact resistance door and thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

B. Field quality control reports.

C. Provide and comply with Florida Building Code Product Approval Notice of Acceptance for exterior hollow metal; doors and frames.

1.7 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place units in maximum stacks of five in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door Products; an ASSA ABLOY Group Company.
2. CURRIES Company; an ASSA ABLOY Group Company.
3. Steelcraft; an Allegion plc Company.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. 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 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.

B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and 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 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.

1. Physical Performance: Level B according to SDI A250.4.
2. Doors:
    a. Type: As indicated in the Door and Frame Schedule.
    b. Thickness: 1-3/4 inches.
    c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
    d. Edge Construction: Model 1, Full Flush.
3. Core: Polystyrene.
4. Frames:
    a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
    b. Construction Type: Face welded.
        1) Locations: All doors with closers; all doors in CMU and Cast-in-Place Concrete partitions.

c. Construction Type: Knockdown.

1) Locations: All other interior doors.

5. Exposed Finish: Prime.
6. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level B according to SDI A250.4.
2. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch with minimum A40 coating.
d. Edge Construction: Model 1, Full Flush.
e. Core: Polystyrene.

3. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
b. Construction: Full profile welded.

1) Locations: All exterior doors

4. Exposed Finish: Prime.
5. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
6. Comply with Florida Building Code Product Approval.

2.5 BORROWED LITES

A. Fabricate of uncoated steel sheet, minimum thickness of 0.042 inch.

B. Construction: Knocked down; face welded where indicated.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; or shipped loose snap in type.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners, welded into frame.

C. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.7 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 zinc-iron-alloy (galvannealed) coating designation.

D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized.

E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.

F. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.

G. 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 standard steel door frames of type indicated.

H. Grout: Comply with ASTM C 476, with a slump of 4 inches for standard steel door frames built into concrete or masonry, as measured according to ASTM C 143/C 143M.

I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.

J. Glazing: Comply with requirements in Section 088000 "Glazing."

K. Bituminous Coating: Cold-applied asphalt coating complying with MIL-C-16173D Type I and Federal Specification TT-C-494B Type II, except containing no asbestos fibers.

1. Basis of Design Manufacturer and Product: Karnak Corp.; Product 118 Black Asphaltum.

2.8 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch high, unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.9 FABRICATION

A. General: Fabricate hollow metal work 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.

B. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Sidelight Frames: Provide closed tubular members with no visible face seams or joints; fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames installed in concrete or masonry.
4. Where installed in masonry, leave vertical mullions in frames open at top for grouting.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. 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 120 inches in height.

4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof more than 120 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 1 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.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."

1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted door hardware.
2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings such 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 doors and frames.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.10 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

2.11 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016-inch thick.

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 standard steel doors and frames.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame 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 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 and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb 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 hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. 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-protection-rated openings, install frames according to NFPA 80.
   b. Where frames are fabricated in sections due to 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, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   g. Apply bituminous coating to backs of frames that are 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.

      1) Maximum penetration of Fasteners: ¾ inch.

3. Metal-Stud Partitions: 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 mortar as specified in Division 4 Section "Unit Masonry Assemblies."
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Install grout in lifts and take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. 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.
7. 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.
8. Installation Tolerances: Adjust standard steel 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.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with standard steel door and frame 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 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 standard steel doors or frames that are warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material off standard steel doors and frames 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 primer.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081423.23 – SOLID PANEL MDF DOORS

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. Section Includes:

1. Interior solid panel MDF doors.
2. Priming solid panel MDF doors.

B. Related Sections:

1. Section 087100 “Door Hardware” for hardware not included in this section.
2. Section 099123 "Interior Painting" for field finishing solid panel doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include details of construction and glazing.

B. Shop Drawings: For solid panel MDF doors. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data, including the following:

1. Dimensions and location of mortises and holes for hardware.

C. Samples for Verification: Corner sections of doors, approximately 8 by 10 inches, with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions and requirements of quality standard referenced.

B. Package doors individually in opaque plastic bags or cardboard cartons.

C. Mark each door on top and bottom edge with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, 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.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship.

1. Failures include, but are not limited to, the following:
   a. Warping (bow, cup, or twist) more than 1/4 inch in 42-by-84-inch section.
   b. Telegraphing of core construction in face veneers exceeding 0.01 inch in 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 shall be in effect during the following period of time from date of Substantial Completion:
   a. Interior Doors: Limited lifetime warranty.

PART 2 - PRODUCTS

2.1 SOLID PANEL MDF DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with Window & Door Manufacturers Association publication ANSI/WDMA I.S. 1A “Industry Standard for Interior Architectural Wood Flush Doors”.

B. WDMA I.S.1-A Performance Grade:

1. Heavy Duty unless otherwise indicated.
2. Fire-Rated Wood Doors: Doors 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.
3. Cores: Provide core as needed to provide fire-protection rating indicated.

4. Pairs: 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. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

2.2 INTERIOR SOLID PANEL MDF DOORS

A. Interior Solid Panel MDF Doors: Doors complying with WDMA I.S.1-A-04, "Industry Standard for Architectural MDF Flush Doors," and with other requirements specified.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Masonite Architectural; Cendura Series.

2. Solid Core Standard Painted Flush Doors:

a. WDMA Quality Standard: Custom.
b. WDMA Performance Level: Heavy Duty.
c. Faces: Tempered hardboard.
d. Vertical Edges: Finger-Jointed Softwood/Mill Option low density hardwood.
e. Horizontal Edges: Structural Composite Lumber.
f. Core: Wood based particleboard.
g. Construction: Five plies. Stiles and rails are bonded to core, and then entire unit is abrasive planed before veneering.
h. Thickness: 1-3/4 inch.

3. Fire-Rated Standard Painted Solid-Core Flush Doors:

a. Match appearance grade and applicable construction and performance requirements of other paint finish flush wood doors.
b. Rating:

1) Category A positive pressure.
2) Category B positive pressure.
3) Neutral pressure.

c. Core:

1) 20-Minute Doors: Wood-based particleboard core.
2) 45-Minute Doors: Fire resistant particleboard core.
3) 60-, 90-Minute Doors: Mineral core.

d. Vertical Edges:

1) 20-Minute Doors: Mill option softwood or low-density hardwood.
2) 45-Minute Fire Resistant Particleboard Core Doors: Veneer edge-band over fire stile.
3) 45-, 60-, 90-Minute Mineral Core Doors: Hardwood composite fire stile.

e. Horizontal Edges:

1) 20-Minute Doors: Structural composite lumber.
2) 45-, 60-, 90-Minute Doors: Manufactures standard construction per label service listing.

4. Panel Design: As selected by the Architect from the Manufacturer’s full range.

a. Molding Profile: Architectural flush molding profile.

2.3 FABRICATION

A. Fabricate solid panel MDF doors in sizes indicated for field fitting.

B. Factory Fitting: Fit to frame openings with clearances specified in WDMA I.S. 1A.

1. Undercut: Maximum 3/8 inch above thresholds.
2. Fire-Rated Doors: Comply with NFPA 80.

C. Factory Machining: Machine doors for hardware that is not surface applied.

1. Verify dimensions for hardware mortises in metal frames before machining.

D. Door Frames:

1. Supply frames with temporary spreader bars at base.

2.4 SHOP PRIMING

A. Finish Grade: Match grade of door.

B. Factory-Primed: Primer suitable for finish paint specified in Section 099123 – Interior Painting. Seal all four edges, edges of cutouts, and mortises with primer.

C. Factory-Painted: WDMA I.S. 1-A System OP-8, UV-Cured Acrylated Polyester/Urethane.

1. Color: As selected by Architect from manufacturer’s full range of colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and substrates, with Installer present, for suitable conditions where MDF stile and rail doors will be installed.

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 087100 "Door Hardware."

B. Install MDF doors to comply with manufacturer's written instructions, WDMA I.S.1-A-04, "Industry Standard for Architectural MDF Flush Doors," and other requirements specified.

C. Field-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.
2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or 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 081423.23

SECTION 081433.13 – STILE AND RAIL MDF DOORS

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. Section Includes:

1. Interior simulated stile and rail wood doors.
2. Priming simulated stile and rail wood doors.
3. Fitting simulated stile and rail wood doors to frames and machining for hardware.

B. Related Sections:

1. Section 099123 "Interior Painting" for field finishing simulated stile and rail doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include details of construction and glazing.

B. Shop Drawings: For simulated stile and rail wood doors. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data, including the following:

1. Dimensions and location of mortises and holes for hardware.

C. Samples for Verification: Corner sections of doors, approximately 8 by 10 inches, with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of door, from manufacturer.

B. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body and is a certified participant in AWI's Quality Certification Program.

B. Source Limitations: Obtain simulated stile and rail wood doors from single manufacturer.

C. Fire-Rated Door Assemblies: 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions and requirements of quality standard referenced in Part 2.

B. Package doors individually in opaque plastic bags or cardboard cartons.

C. Mark each door on top and bottom edge with opening number used on Shop Drawings.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, 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.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship, or have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:

a. Interior Doors: Ten years.

PART 2 - PRODUCTS

2.1 INTERIOR STILE AND RAIL MDF DOORS

A. Interior Simulated Stile and Rail Wood Doors: Fire-rated (20-minute rating) doors complying with WDMA I.S.1-A-04, "Industry Standard for Architectural Wood Flush Doors," and with other requirements specified.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ABS Manufacturing; Millennium Infinity Doors.
2. Panel Design: As selected by Architect from manufacturer's full range.
3. Door Construction: 1/8-inch MDF bonded to particleboard core; 1-inch softwood stiles, 2-1/4-inch wood top and bottom rails.
    a. Thickness: 1-3/4 inch.
4. Stile and Rail Widths: Manufacturer's standard, but not less than the following:
    a. Stiles, Top and Intermediate Rails: 4-1/2 inches.
    b. Bottom Rails: 10 inches.
5. Molding Profile: Architectural 1-panel molding profile.

2.2 MATERIALS

A. General: Use only materials that comply with referenced standards and other requirements specified.

1. Assemble interior doors, frames, and sidelites, including components, with either dry-use or wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.

B. Certified Wood: Stile and rail wood doors shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

C. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.

D. Panel Products: Any of the following unless otherwise indicated:

1. Particleboard made from wood particles, with binder containing no urea-formaldehyde, complying with ANSI A208.1, Grade M-2.
2. Particleboard made from straw, complying with ANSI A208.1, Grade M-2, except for density.
3. Medium-density fiberboard made from wood fiber, with binder containing no urea-formaldehyde, complying with ANSI A208.2, Grade 130.
4. Hardboard complying with ANSI A135.4.
5. Veneer-core plywood made with adhesive containing no urea-formaldehyde.

2.3 FABRICATION

A. Fabricate simulated stile and rail wood doors in sizes indicated for field fitting.

2.4 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime doors with one coat of wood primer specified in Division 9 Section "Interior Painting." Seal all four edges, edges of cutouts, and mortises with primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and substrates, with Installer present, for suitable conditions where wood stile and rail doors will be installed.

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 Division 8 Section "Door Hardware."

B. Install wood doors to comply with manufacturer's written instructions, WDMA I.S.1-A-04, "Industry Standard for Architectural Wood Flush Doors," and other requirements specified.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Field-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.
    a. Comply with NFPA 80 for fire-rated doors.
2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches on lock edge; trim stiles and rails only to extent permitted by labeling agency.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or 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 081433.13

SECTION 081450 – PREASSEMBLED WOOD DOOR AND FRAME UNITS

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:

1. Interior solid core and hollow core doors with molded hardboard, faces and low-density composite core.
2. Factory fitting wood doors to frames and factory machining for hardware.

B. Related Sections:

1. Section 087100 “Door Hardware” for hardware not specified in this Section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with NWWDA I.S.1-A, "Architectural Wood Flush Doors" and “Wood Moulding and Millwork Producers Association Quality Standards (WMI-89)”.

1. Door Jamb Grade: P Interior Grade in accordance with WMI-89.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. Manufacturer's Standard Warranty: Assemblies will be free from defects in materials and workmanship from the date of manufacture for the time periods indicated below.

1. Door Slabs: 5 years for defects in material and workmanship.
2. Door Frames: 1 year for defects in material and workmanship.

PART 2 - PRODUCTS

2.1 SOLID-CORE WOOD DOORS

A. Basis-of-Design Manufacturer and Product: Subject to requirements provide the following where indicated on the drawings:

1. Manufacturer: Jeld-Wen.
2. Product: Madison Smooth All-Panel (Molded Wood Composite Door) 1-Panel Doors with NAUF Option.

B. Solid-Core Doors: 1-3/8” side-hinged door system.

1. Door Panel: Solid core doors.
2. Door Style: All-panel.
3. Core: ProCore Solid Core with NAUF option.
    a. Thickness: 1-3/8 inch.

C. Wood Frame: Combination wood/MDF frame.

D. Hardware:

1. Prep door for owner supplied hinge and lockset.
2. Face Bore: Standard.
3. Backset: Standard.
4. Edge Bore: 1-inch with mortise for 1-inch by 2-1/4 inch latch faceplate with 1/4 inch radius corners.

E. Hardware Finish: As selected by the Architect from the Manufacturer’s full range.

F. Door and Frame Finish: Primed.

2.2 HOLLOW CORE WOOD DOORS

A. Basis-of-Design Product: Subject to requirements provide the following where indicated on the drawings:

1. Manufacturer: Jeld-Wen.
2. Product: Madison – Smooth, All-Panel (Molded Wood Composite Door) door 1-panel doors with NAUF option.

B. Hollow-Core Doors: 1-3/8” side-hinged door system.

1. Door Panel: Hollow core doors.
2. Door Style: All-panel.
3. Core: Hollow core with corrugated honeycomb core.
   a. Thickness: 1-3/8 inch.

C. Wood Frame: Combination wood/MDF frame

D. Door and Frame Finish: Primed.

1. Color: As selected by the Architect from the Manufacturer’s full range.

E. Overhead Latches: Provide manufacturer’s standard ball-catch overhead latches for double doors.

2.3 WOOD FRAMES

A. Door Frame: Wood jambs shall be fabricated as a flat jamb with doorstop applied or 2-piece split jamb. Hinge jamb preparations for 1-3/8” thick doors to be machined for standard weight radius mortise 3-1/2" hinges. Strike jamb preparations are to be machined for full lip cylindrical strike plate. Double door units shall include preparations for ball catch located at the top of door on both door panels designed to strike into the head jamb.

B. Hinges: Three standard weight radius mortise hinges are required on doors 7’-0” height or smaller.

C. Silencers: Drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.

1. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
2. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

2.4 HARDWARE

A. Hinges: Manufacturer’s standard, weight radius mortise hinges.

1. Finish: Match unit door hardware.

2.5 FABRICATION

A. Factory fit doors to frame, with the following uniform clearances and bevels, unless otherwise indicated:

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

2.6 FACTORY PRIMING

A. Factory-Primed: Primer suitable for finish paint specified in Section 099123 – Interior Painting. Prime paint all four edges, edges of cutouts, and mortises with primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Replace doors that are damaged or 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 081450

SECTION 083113 - 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. Section includes:

1. Access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.

C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.5 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Wherever a fire-resistance classification is indicated, provide access door and panel assemblies with panel door, frame, hinge, and latch from manufacturer listed in Underwriter's Laboratories (UL), "Building Materials Directory" for rating shown.

1. Provide 90 minute UL label at 2-hour rated partitions.
2. Provide 3 hour Warnock Hersey label at horizontal applications, up to 24 inch wide x 36 inch high.
3. Provide 2 hour Warnock Hersey label at horizontal applications greater than 24 inch wide x 36 inch high.

1.6 DELIVERY, STORAGE AND HANDLING

A. Package and ship per manufacturer’s recommendations.

B. Store per manufacturer’s instructions.

1. Store in dry area out of direct sunlight.

1.7 WARRANTY

A. Provide manufacturer's written warranty.

B. Warrant materials and fabrication against defects after completion and final acceptance of Work.

C. Repair defects, or replace with new materials, faulty materials or fabrication developed during the warranty period at no expense to Owner.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Fire Rated Flush Access Doors with Concealed Flanges: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assembled units are to be installed

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Acudor Products, Inc.
b. Product: Model FWC 5015.

2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge and minimum 2-inch-thick fire rated insulation.
3. Locations: Ceiling and wall.
4. Door Size: As indicated on the drawings.
5. Fire-Resistance Rating: Not less than that of adjacent construction.
6. Temperature-Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
7. Uncoated Steel Sheet for Door: Nominal 0.036 inch (20 gauge), factory finished.
8. Frame Material: 16 gauge; same material and finish as door.
9. Latch and Lock: Self-closing, self-latching door hardware, operated by knurled-knob, with interior release.
10. Finish:5 stage iron phosphate preparation with prime coat of white baked on enamel.

B. Flush Access Doors with Concealed Flanges: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assembled units are to be installed

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Acudor Products, Inc.

b. Product: Model DW 5040.

2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge and minimum 2-inch-thick fire rated insulation.
3. Locations: Ceiling and wall.
4. Door Size: As indicated on the drawings.
5. Uncoated Steel Sheet for Door: Nominal 0.036 inch (20 gauge), factory finished.
6. Frame Material: 16 gauge; same material and finish as door.
7. Latch and Lock: Self-closing, self-latching door hardware, operated by knurled-knob, with interior release.
8. Finish:5 stage iron phosphate preparation with prime coat of white baked on enamel

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

D. Frame Anchors: Same material as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces 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, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

D. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

E. Recessed Panel: Form face of panel to provide specified recess for application of finish material. Reinforce panel as required to prevent buckling.

2.4 FINISHES

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.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
2. Finish Coat: Match adjacent ceiling or wall surface color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates 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. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install frames plumb and level in opening. Secure rigidly in place.

C. Position units to provide convenient access to concealed Work requiring access.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 083324 – SECTIONAL OVERHEAD 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 insulated steel sandwich sectional overhead door.
2. Electric door operators.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.3 ACTION 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.
4. Operation and maintenance data.
5. Nameplate data and ratings for motors.

B. Shop Drawings: Include opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

C. 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.

D. 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.

1.5 CLOSEOUT SUBMITTALS

A. Manufacturer Qualifications: Minimum ten years of documented experience.

B. Installer Qualifications: Minimum five years of documented experience, and authorized by the door manufacturer.

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 and ICC A117.1.

1.7 WARRANTY

A. Manufacturers Limited Warranty steel sectional overhead doors.

1. Standard finish warranty against cracking, checking, or peeling for 10 years.
2. Custom color option Color Blast Finish limited warranty period for 5 years.
3. Delamination warranty for 10 years; Parts and Hardware for 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Clopay Corporation.

1. Product: Model 3723.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

1. Design Wind Load: As indicated on Drawings.
2. Testing: According to ASTM E 330.
3. Deflection Limits: Design sectional overhead doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
4. Operability under Wind Load: Design sectional overhead doors to remain operable under uniform pressure (velocity pressure) of 20 lbf/sq. ft. wind load, acting inward and outward.

B. Operation: Design door assembly, including operator, to operate for not less than 25,000 cycles.

2.3 FLUSH STEEL DOORS, THERMALLY BROKEN, POLYURETHANE INSULATED

A. Door Construction:

1. Panels: Foamed in place Polyurethane core construction between exterior and interior steel skins.
2. Steel Skins: Formed from roll formed commercial or drawing quality steel sheet, hot-dip galvanized per ASTM A 924/A 924M and ASTM A 653/A 653M, pre-painted with primer and baked-on polyester topcoat; sections formed to create weather tight tongue-in-groove meeting joint.
3. Reinforcing: Galvanized and primed steel reinforcement located under each hinge location, pre-punched for hinge attachment.

B. Premium Duty 2-inches Door:

1. Style: Raised panel steel doors, thermally broken, polyurethane insulated.
2. Maximum Door Size: 32 feet, 2 inches wide by 26 feet high.
3. Overall Panel Thickness: 2-inches.
4. Steel Skin Thickness: Minimum 27 gauge exterior; minimum 27 gauge interior.
5. End Stiles: Galvanized steel end stiles, engineered for easy hardware attachment through pre-punched holes. Minimum 18 gauge, 0.045 inch thick for single end hinge style and 16 gauge .056 inch minimum for double end hinge style.
6. Astragal: U-shaped flexible PVC in retainer of full-length 0.055 inch rigid PVC.
7. Thermal Resistance (R-value): 18.4 deg F hr sq ft/Btu; calculated door section R-value in accordance with DASMA TDS-163.
8. Insulation: CFC-free and HCFC-free polyurethane, fully encapsulated.
9. U-Factor: 0.16.
10. Air Infiltration: .022 cfm @ 25 mph.
11. Windows: Extruded polypropylene windows measuring 8 inches by 24 inches.
    a. Glazing: 7/8 inch insulated tempered glass.
12. Finish: Wood grain embossed texture, white interior color, exterior as follows:
    a. As selected by the Architect from the manufacturer’s full range.
13. Locking:
    a. Provide two inside slide locks.
14. Door Drop Safety Device: Provide brackets designed to stop the fall of the door should lift cables fail.
15. Weatherstripping: Provide complete perimeter seals. Provide flexible top seal, flexible jamb seal and U shaped bottom seal.
16. Track:
    a. 2 inches track designed for 2” diameter rollers. Vertical tracks minimum 0.061 inch galvanized steel. Horizontal tracks minimum 0.075 inch galvanized steel.
17. Spring Counterbalance: Torsion spring counterbalance mechanism sized to weight of the door, with high strength galvanized aircraft cable with minimum 7 to 1 safety factor.
    a. High Cycle Spring: 25,000 cycles.
18. Break-Away Bottom Section: Integral part of door; with fiberglass or 1/8 inch polycarbonate lined bottom section with flexible neoprene rubber side edges; exterior to match door face.

a. Single breakaway bottom section for doors up to 20 feet wide.

2.4 ELECTRIC DOOR OPERATORS

A. General: Provide electric door operator provided by door manufacturer for door with operational life specified complete with electric motor and factory pre-wired motor controls, starter, gear-reduction unit, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation. Comply with NFPA 70.

1. Solenoid-operated brake.

B. Disconnect Device: Provide hand-operated disconnect or mechanism for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

C. Design operator so motor may be removed without disturbing limit switch adjustment and without affecting emergency auxiliary operator.

D. Provide control equipment complying with NEMA ICS1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, AC or DC.

E. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motor, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or considering service factor.

1. Type: Solid State.
2. HP: 1/2 hp.
3. Power Characteristics: 115V/1 phase.
4. Service Factor: NEMA MG 1.
5. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.

F. Remote Control Station: Provide momentary contact, 3-button control station with push - button controls labeled "Open", "Close" and "Stop”.

G. Provide interior units, fully guarded, surface mounted, heavy-duty type, with general-purpose NEMA ICS 6 enclosure in one of the following types:

1. Enclosure Type: Type 1.

H. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor able to protect full width of door opening. Activation of sensor immediately stops and reverses downward door travel.

1. Sensor Edge: Provide each motorized door with an automatic safety sensing edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cord. Sensing edge shall be operated by:

a. Electric Fail safe.

2. Photo-electric control: Provide each motorized door with a photo-electric device that will stop and reverse the downward door travel if the light beam is broken or blocked. Device shall be:

   a. NEMA Type 1.

I. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

J. Radio Controls: Provide 3 button radio transmitter to provide remote open, close, stop functionality.

1. Provide external antenna and coaxial wiring to receiver to enhance radio control reception.

K. Provide auxiliary chain hoist: for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine wall and overhead areas, including opening framing and blocking, with installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work in this Section.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

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 sectional overhead 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 sectional overhead doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Coordinate installation of electrical service with Division 26. Complete wiring from disconnect to unit components

D. Accessibility: Install sectional overhead doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

E. Power-Operated Doors: Install according to UL 325.

F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 079200 – Joint Sealants.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Perform installation and startup checks according to manufacturer's written instructions.
2. 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.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Release device(s) shall be tested and witnessed for proper operation with the door manufacturer recommendations.

D. Adjust seals to provide tight fit around entire perimeter.

3.6 PROTECTION

A. Protect installed products until completion of project.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional overhead doors.

END OF SECTION 083324

SECTION 083486 – OVERHEAD COILING SMOKE CONTAINMENT ENCLOSURE

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. Section Includes:

1. Overhead coiling smoke curtains for elevator doors.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.
2. Division 26 Sections for electrical service and connections and fire alarm.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of smoke containment door and accessory. Include the following:

1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes. Include substrate preparation instructions and recommendations and installation means and methods.
2. 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. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, details indicating the section and elevation views of each product, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Warranty Information: Submit confirmation and details of manufacturer’s warranty, extended warranty, and replacement policies.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer: Minimum of seven (7) years' experience in manufacturing draft-control curtain assemblies at a facility in the United States that have been successfully installed in compliance with requirements of authorities having jurisdiction.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

C. Smoke Control Door Assemblies: Assemblies that are listed and labeled by a qualified testing agency, for smoke control.

1. Smoke Control: 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.

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.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials and products in accordance with the manufacturer's instructions and recommendations and industry standards.

B. Store all materials in the manufacturer's original packaging until ready for installation. Protect all products from damage or exposure to adverse weather conditions.

1.8 PROJECT CONDITIONS

A. Prior to fabrication, verify that dimensions are consistent with those found in the construction drawings. Where discrepancies exist, confirm the proper dimensions with the Architect before proceeding with work.

1.9 WARRANTY

A. Manufacturer Warranty: Provide manufacturer's warranty covering parts and labor costs to repair or replace parts that fail to perform.

1. Warranty Period: Parts and labor warranty for 12 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain smoke containment doors from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Air Leakage: Not to exceed 3 cfm (0.001416 m^3/s) per sf of door opening at 0.1 in (25 Pa) water pressure differential at ambient temperature and 400 degrees F (204 degrees C) tested per IBC 2006, 2009, and 2012.

2.3 SMOKE-PROTECTIVE CURTAIN ASSEMBLIES FOR ELEVATOR ENTRANCES

A. Alarm-activated transparent-film smoke curtain assembly complying with ICC-ES AC77 and NFPA 105.

1. Basis-of-Design Manufacturer and Product: Subject to compliance with requirements, provide Model 600, by Smoke Guard, a CSW Industrials Company.

B. Smoke-Protective Curtain Assemblies: Provide smoke-protective curtains listed and labeled with the letter "S" by a qualified testing agency for smoke- and draft-control based on testing in accordance with UL 1784 without an artificial bottom seal; with maximum air-leakage rate of 3.0 cfm/sq. ft. (0.01524 cu. m/s x sq. m) of opening at 0.10 inch wg (24.9 Pa) for both ambient and elevated temperature tests in accordance with ICC-ES AC77.

C. Curtain Materials: Provide manufacturer’s standard curtain complying with each of the following:

1. Flame-Spread and Smoke-Developed Indexes: No greater than 25 and 50, respectively, when tested in accordance with ASTM E84.
2. Transparent-Film Curtain: Provide curtain of transparent film in compliance with vision panel requirements of ASME A17.1.
3. Screen Reinforcement: Provide film with reinforcement to limit deflection or tearing.

D. Curtain Egress: Provide curtain that is operable from the egress side without use of keys, tools, special knowledge, or effort in excess of the opening force requirements of authorities having jurisdiction.

1. Egress Switch: Include switch to rewind screen into housing to comply with egress requirements of ASME A17.1.
    1. Switch Size and Color: Provide switch no less than 4 by 4 inches and in contrasting color with curtain.
    2. Switch Operation: Provide switch operable with a closed fist or a loose grip, not requiring finger movements in compliance with the requirements of authorities having jurisdiction.
    3. Switch Location: Centered on screen between 15 and 48 inches above finished floor level in compliance with forward reach requirements of authorities having jurisdiction.
2. Manual Egress: Provide curtain allowing fail-safe manual egress with less than 15 pounds release pressure in the direction of travel.

1. Opening Size: Provide curtain with manual egress opening of at least 32 inches in compliance with the requirements of authorities having jurisdiction.

E. Curtain Attachment: Provide curtain that forms a pressure-resisting seal by magnetic adhesion with flexible multi-pole magnetic strips attached to longitudinal edges of film with low modulus silicone adhesive.

1. Curtain Installation: Provide curtain attachment systems that do not require modification of the elevator jamb including direct or mechanical attachment.
2. Elevator Door Frame Method: Type 430 ferritic stainless steel elevator door frames to create seal with curtain by magnetic adhesion.
    1. Auxiliary Rails: Provide 16-gauge ASTM A240/240M, Type 430, ferritic stainless steel vertical rails above elevator door head to create seal with curtain by magnetic adhesion no less than 2 inches wide.
3. Auxiliary Rail Method: Provide vertical rails to create seal with curtain by magnetic adhesion.
    1. Material: 16-gauge ASTM A240/240M, Type 430, ferritic stainless steel.
    2. Size: At least 2 inches wide.

F. 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.

G. Curtain Housing: Provide sheet metal housings containing support rollers and associated electronics.

1. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
2. Housing includes electrical junction box that does not require the removal of any part of the building in accordance with NFPA 70.
3. Provide electrical junction box access through housing in the open condition.
4. Curtain housing to contain all components required for operation.
5. Housing Finish: Manufacturer’s standard powder coat finish in white.
6. Housing Finish: Manufacturer’s standard powder coat finish in custom RAL color.
7. Housing Finish: Manufacturer’s standard stainless steel.

H. Curtain Operation: Motorized controlled descent and rewind with battery backup fail-safe.

1. Curtain deploys on activation of one of the following:
    1. Local Smoke Detector.
    2. Building Fire Alarm.
    3. Testing Key Switch.
2. Release Mechanism: Labelled as defined by UL864.

2.4 ACCESSORIES

A. End of Line Diode: Provide manufacturer’s standard diode device installed at smoke detector to monitor the circuit.

1. Power Requirements: 3.3 Volts, 2 Watts.

B. Firefighter's Smoke Control Station (FSCS): Provide manufacturer's standard integration with FSCS with the following functionality:

1. Open/Retract Curtain.
2. Open Confirm.
3. Open Fault Alert.
4. Close/Deploy Curtain.
5. Close Confirm.
6. Closed Fault Alert.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which work will be installed.

1. Verify related work performed under other sections is complete and in accordance with Shop Drawings.
2. Verify wall surfaces and elevator door frames are acceptable for installation of smoke containment system components.
3. Verify existing field painted elevator door frames to be used for screen adherence have been repainted in accordance with smoke containment system manufacturer's instructions or they have the original factory paint.

B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Verify that locations of concealed reinforcements have been clearly marked for the installer.

E. Locate reinforcement points and clearly mark their locations if not already done.

3.2 PREPARATION

A. Clean surfaces prior to installation.

B. Prepare surfaces as recommended by the manufacturer for achieving optimal results.

3.3 INSTALLATION

A. Install smoke containment system components in accordance with manufacturer's installation instructions.

B. Install in accordance with all code bodies having jurisdiction.

3.4 CLEANING AND PROTECTION

A. Clean and remove all stains, grime, or other soils using soap and water. Only use detergents approved by the manufacturer for use on the finishes specified. Do not use acid solutions, steel wool, and other harsh abrasives.

B. Damaged products must be repaired or replaced prior to substantial completion.

C. Protect installed products until completion of work specified in this section.

3.5 FIELD QUALITY CONTROL

A. Field Test: Follow manufacturer's cycle test procedures.

1. Notify Owner's Representative, local Fire Marshal, alarm sub-contractor and elevator sub-contractor minimum one week in advance of scheduled testing.
2. Complete maintenance service record.

3.6 DEMONSTRATION

A. Demonstrate required testing and maintenance procedures to Owner's Representative

B. Maintenance and Testing:

1. Perform minimum semi-annual maintenance and testing on each smoke containment system as required by the manufacturer's warranty, code agency evaluation reports, and as required by local authority having jurisdiction.
2. Backup Battery: Test semi-annually and replace every three years minimum.
3. Retain permanent record of tests.

C. Future Painting: Paint elevator door frame and/or auxiliary rails in accordance with Operation and Maintenance Manual.

D. Fire Event: Owner shall engage a qualified inspector to assess unit(s) after exposure to a fire event.

END OF SECTION 083486

SECTION 084113 - 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 impact-resistant aluminum-framed storefront framing.
2. Exterior impact resistant aluminum-framed manual-swing entrance doors and door-frame units.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

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.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Initial Selection: For units with factory-applied color finishes. Provide samples of hardware and accessories involving color selection.

D. Samples for Verification: Provide a verification sample for aluminum-framed storefront system and required components.

E. Product Test Reports:

1. Provide test reports for each type of aluminum-framed storefront used in the project.
2. Test reports must be based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency.
3. Test reports must indicate compliance with performance requirements.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

G. Entrance Door Hardware Schedule:

1. Schedule shall be prepared by or under the supervision of supplier.
2. Schedule shall detail fabrication and assembly of entrance door hardware, including procedures and diagrams.
3. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

H. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Preconstruction Laboratory Mockup Testing Submittals:

1. Testing Program: Developed specifically for Project.
2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.

B. Qualification Data: For Installer.

C. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Installer must have successfully installed the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications:

1. Manufacturer must be capable of providing aluminum-framed storefront systems that meet or exceed performance the stated performance requirements.
2. Manufacturer must document this performance by the inclusion of test reports and calculations.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

D. Comply with Florida Building Code Product Approval or Miami-Dade NOA where applicable.

1.8 MOCKUPS

A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.
2. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PROJECT CONDITIONS

A. Field Measurements:

1. Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication.
2. Indicate measurements on shop drawings.

1.10 WARRANTY

A. Special 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, metal finishes, and other materials beyond normal weathering.
    d. Water penetration through fixed glazing and framing areas.
    e. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 10 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 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. 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. Product to comply with the specified performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction, as determined by testing of aluminum storefront systems representing those indicated for this project.
2. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
3. Failure also includes the following:

    a. Thermal stresses transferring to building structure.
    b. Glass breakage.
    c. Loosening or weakening of fasteners, attachments, and other components.
    d. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on the Structural Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

E. Windborne-Debris-Impact Resistance Performance: Shall be tested in accordance with ASTM E 1886, information in ASTM E 1996 and TAS 201/203:

1. Large-Missile Impact: For aluminum-framed systems located within 30 feet of grade.
2. Small-Missile Impact: For aluminum-framed systems located above 30 feet of grade.

F. Air Leakage: The test specimen shall be tested in accordance with ASTM E 283. Air Leakage rate shall not exceed 0.06 cfm/ft2 at a static air pressure differential of 6.2 psf with interior seal, or rate shall not exceed 0.06 cfm/ft2 at a static air pressure differential of 1.6 psf without interior seal.

G. Uniform Load: A static air design load of 30 psf shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

H. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 68 (frame) and 70 (glass low-e).

I. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC): When tested to AAMA Specification 1801 and in accordance with ASTM E1425 and ASTM E90, the STC and OITC Rating shall not be less than38 (STC) and 33 (OITC).

J. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 15 psf as defined in AAMA 501.

K. Thermal Transmittance (U-Factor): When tested to AAMA Specification 1503, AAMA Specification 507 or NFRC 100 the thermal transmittance (U-Factor) shall not be more than:

1. 1" Laminated Insulating Glass:
   a. U-Factor not more than .33 BTU/hr/ft2/°F per AAMA 1503 with exterior 1/4" clear with e=0.035 low-e coating on surface #2, 1/2" air space with warm edge spacer and 90% argon gas fill, and interior 1/4" clear glass.

2.2 MANUFACTURERS

A. Basis of Design Manufacturer: Kawneer North America; an Alcoa company.

1. Product: IR 501T Framing System - Impact Resistant.
   a. Swing Doors: IR 351 Swing Doors; Medium stile 3-½” vertical face dimension, 1-¾” depth.

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. 2-3/4" x 5" nominal dimension.
3. Glazing System: Retained mechanically with gaskets on four sides.
4. Glazing Plane: Center.
5. Glazing: 1-5/16" impact resistant glazing.
6. Finish: High-performance organic finish.
    a. Color: As selected by the Architect from the manufacturer’s full range.
7. Fabrication Method: Screw spline fabrication system.

2.4 MATERIALS

A. Aluminum Extrusions:

1. Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish.
2. Not less than 0.070" wall thickness at any location for the main frame.
3. Complying with ASTM B221: 6063-T6 alloy and temper.
4. Recycled Content:
    a. Shall have a minimum of 50% mixed pre- and post-consumer recycled content.
    b. Indicate recycled content, including the percentage of pre- and post-consumer recycled content per unit of product.
    c. Indicate the relative dollar value of recycled content product to the total dollar value of product included in the project.
    d. Indicate the location for recovery of recycled content.
    e. Indicate the location of the manufacturing facility.

B. Fasteners:

1. Aluminum, nonmagnetic stainless steel or other materials must be non-corrosive and compatible with aluminum members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories:

1. Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating.
2. Anchors, clips, and accessories shall provide sufficient strength to withstand the design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

F. Tolerances: References to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.5 STOREFRONT FRAMING SYSTEM

A. Thermal Barrier:

1. IR 501T - Kawneer DUAL IsoLock™ Thermal Break with two (2) 1/4" separations consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.

a. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.

C. Perimeter Anchors:

1. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

D. Packing, Shipping, Handling, and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

E. Storage and Protection:

1. Store materials so that they are protected from exposure to harmful weather conditions.
2. Handle material and components to avoid damage.
3. Protect material against damage from elements, construction activities, and other hazards before, during, and after installation.

2.6 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Concealed Flashing: 0.050 Aluminum Sill Flashing End Dams shall have 3 point attachment.

2.7 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual out-swing operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

2. Door Design: Medium stile; 3 ½ inch nominal width.

   a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

   a. Provide non-removable glazing stops on outside of door.

2.8 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware.

2.9 ACCESSORIES

A. Joint Sealants For installation at perimeter of aluminum-framed systems, as specified in Division 07 Joint Sealants Section.

B. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.10 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. 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. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.

5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. At exterior doors, provide weather sweeps applied to door bottoms.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.11 ALUMINUM FINISHES

A. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent 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.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

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 the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system, accessories, and other components.

B. Install aluminum-framed storefront system so that components:

1. Are level, plumb, square, and true to line.
2. Are without distortion and do not impede thermal movement.
3. Are anchored securely in place to structural support.
4. Are in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather-tight construction.

D. Install aluminum-framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront system to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.4 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.5 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.6 FIELD QUALITY CONTROL

A. Field Tests:

1. Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured.

2. Conduct tests for air infiltration and water penetration with manufacturer's representative present.

3. Tests that do not meet the specified performance requirements and units that have deficiencies shall be corrected as part of the contract amount.

4. Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements.

5. Air Infiltration Tests:

   a. Conduct tests in accordance with ASTM E 783.
   b. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft^2, whichever is greater.

6. Water Infiltration Tests:

   a. Conduct tests in accordance with ASTM E 1105.
   b. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.2 psf.

B. Manufacturer's Field Services: Upon owner's written request, provide periodic site visit by manufacturer's field service representative.

3.7 ADJUSTING, CLEANING AND PROTECTION

A. Adjusting: Not applicable.

B. Protection: Protect installed product's finish surfaces from damage during construction.

C. Cleaning:

1. Clean glass immediately after installation.

   a. Comply with glass manufacturer's written recommendations for final cleaning and maintenance.
   b. Remove non-permanent labels and clean surfaces.

2. Clean aluminum surfaces.
3. Avoid damaging protective coatings and finishes.
4. Remove excess sealants, glazing materials, dirt, and other substances.
5. Repair or replace damaged installed products.
6. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the construction period.
7. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 084113

SECTION 084118 – ALUMINUM 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. Exterior manual-swing doors and door-frame units.

B. Related Sections:

1. Section 084413 “Aluminum-Framed Entrances and Storefronts.”
2. Section 084229.23 "Sliding Automatic Entrances" for sliding automatic entrances.

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. Air Infiltration: When tested in accordance with ASTM E283 at differential static pressure of 6.24 PSF (299 Pa), completed storefront systems shall have maximum allowable infiltration of 0.3 CFM/FT2.

B. Water Infiltration: No uncontrolled water other than condensation on indoor face of any component tested in accordance with ASTM E331 and ASTM E547 at a test pressure differential of 13.5 psf (0.65 kPa) for storefront and 12 psf (0.57 kPa) for entrances.

C. Deflection: Deflection of mullion and transom members: No deflection greater than 1/180 span at positive and negative certified design load applied to tributary area following FBC TAS 202.

D. Accessibility: Comply with pertinent requirements of Americans with Disabilities Act (ADA).

1. Hurricane Resistance: Large Missile/Small Missile, tested in accordance with FBC TAS201, TAS202, TAS203 for storefront, and for a door panel size of 36 inches by 95.5 inches.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Manufacturer's data sheets on each product to be used.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Typical installation methods.
5. Provide detailed data on manufacturers catalog data on each product to be used, including Miami Dade County Product Approval (NOA) and Florida Building Code (FBC) HVHZ Product Approval.

B. Shop Drawings: Include details of materials, construction and finish. Include relationship with adjacent construction.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Welding certificates.

C. Preconstruction Test Reports: For sealant.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for door systems, indicating compliance with performance requirements.

E. Source quality-control reports.

F. Comply with Florida Building Code Product Approval Notice of Acceptance.

G. Field quality-control reports.

H. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For door systems to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Engineering Responsibility: Prepare data for door systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

D. Comply with Florida Building Code Product Approval Notice of Acceptance.

E. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

F. Source Limitations for Door Systems: Obtain from single source from single manufacturer.

G. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

H. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

I. 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 typical wall area as shown on Drawings.
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.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for door systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

1.11 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide CGI Impact Resistant Windows and Doors; Product: 450 Estate Aluminum French Door Series(Outswinging).

2.2 IMPACT RESISTANT ALUMINUM DOORS AND FRAMES

A. Product Characteristics:

1. Construction: 4-5/8 door stile, 4-7/8 inches top rail, 7 inches bottom rail, 1-3/4 inches thick, 0.125 inch wall thickness.
2. Corner Construction: Combination screw spline/shear block construction.
3. Glazing: 9/16 inch laminated glass.

B. Hardware: As indicated in Section 087100 – Door Hardware.

C. Transoms:

1. Basis of Design Manufacturer and Product:

a. Manufacturer: CGI Doors and Windows, Inc.
b. Product: Clipped Mullion; Series 450 Transom Aluminum Fixed Window - L.M.I.

D. Mullions:

1. Basis of Design Manufacturer and Product:

a. Manufacturer: CGI Doors and Windows, Inc.
b. Product: Clipped Mullion; Series 450 Extruded Aluminum Tube Mullion with 509 Framing Member - L.M.I.

2.3 MATERIALS

A. Extrusions: Aluminum alloy and temper; 6063-T6, ASTM B 221.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Section 088000 "Glazing" and as follows:

1. Large and Small Impact Glazing:

a. Glass: 1” insulated laminated impact glass (Glass Type A1); clear.
b. Laminated Glass Composition: 1/4” tempered glass with 0.30” air space and 3/16” annealed glass with 0.075” interlayer (Saflex CP with PET Core by Eastman Chemical Co.) and 3/16” annealed glass.

2. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

3. Glazing Spacer: Custom EPDM spacer as manufactured by Tremco, Dow Corning #995 structural silicone and Tremco EPDM wedge.

2.5 ACCESSORIES

A. Manufacturer's Standard Accessories:

1. Fasteners: Zinc plated steel concealed fasteners; Stainless Steel or Hardened aluminum alloys exposed fasteners, countersunk, finish to match aluminum color.
2. Perimeter Sealant: Non-skinning type, AAMA 803.3.

3. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer. Glazing gaskets in accordance with ASTM C 864.

2.6 FINISHES

A. High Performance Organic Coating Finish: Manufacturer's standard high-performance finish. AAMA 2603.

1. 2-Coat: Color as selected by the Architect from the Manufacturer’s full range.
2. Color: Bone White.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. 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. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.

E. Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly constructed and prepared.

B. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions. Verify openings are sized to receive storefront system and sill plate is level in accordance with manufacturer's acceptable tolerances.

C. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

D. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. 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. General:

1. Comply with manufacturer's written instructions and Florida Building Code Product Approval Notice of Acceptance requirements.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by 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.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Section 088000 "Glazing."

G. Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install perimeter joint sealants as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

3.4 ERECTION TOLERANCES

A. Install door systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:
    a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
    b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner reserves the right to engage a qualified independent testing and inspecting agency to perform field tests and inspections.

B. Testing Services: Test and inspect installed aluminum terrace doors as follows:

1. Testing Methodology: Test aluminum terrace doors for air infiltration and water resistance 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 aluminum terrace doors of each type as selected by Architect and a qualified independent testing and inspecting agency. Conduct tests after perimeter sealants have cured.

5. Test Reports: Prepared according to AAMA 502.

C. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Door assemblies will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

3.7 CLEANING AND PROTECTION

A. Clean products in accordance with the manufacturer's recommendations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

1. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum storefront from damage from grinding and polishing compounds, plaster, lime, acid, cement or other harmful contaminants.

END OF SECTION 084118

SECTION 084229.23 – SLIDING AUTOMATIC ENTRANCES

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. Section includes:

1. Exterior and interior, single slide and bi-parting, impact rated, sliding automatic entrances.

1.3 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.

C. IBC: International Building Code.

D. Safety Device: Device that prevents a door from opening or closing.

E. For automatic door terminology, refer to BHMA A156.10.

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 individual components and profiles and finishes for automatic entrance doors.
2. Include rated capacities, operating characteristics, electrical characteristics and furnished specialties and accessories.

B. Shop Drawings: For automatic entrances.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. 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.
4. Indicate locations of activation and safety devices.
5. Include hardware schedule and indicate hardware types, functions, quantities, and locations.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For automatic entrances.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Product Certificates: For each type of emergency-exit automatic entrance door, signed by product manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for automatic entrance door assemblies.

D. Sample Warranties: For manufacturer’s special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For automatic entrances, safety devices and control systems to include in operation and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer with a manufacturing facility certified under ISO 9001.

1. Manufacturer shall have in place a national service dispatch center providing 24 hours a day, 7 days a week, emergency call back service.

B. Installer Qualifications: Manufacturer's authorized representative, with certificate issued by AAADM, who is trained for installation and maintenance of units required for this Project.

C. Certified Inspector Qualifications: Certified by AAADM.

D. Source Limitations: Obtain automatic entrance door assemblies through one source from a single manufacturer.

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. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.

1.9 PROJECT CONDITIONS

A. Field Measurements: General Contractor shall verify openings to receive automatic entrance door assemblies by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Mounting Surfaces: General Contractor shall verify all surfaces to be plumb, straight and secure; substrates to be of proper dimension and material.

C. Other trades: General Contractor shall advise of any inadequate conditions or equipment.

1.10 COORDINATION

A. Templates: Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrances to comply with indicated requirements.

B. During the warranty period the Owner shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.

C. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

1.11 WARRANTY

A. Automatic Entrances shall be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

B. During the warranty period the Owner shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.

C. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

1.12 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of automatic entrance door assembly Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance door assembly operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1. Engage a certified inspector to perform safety inspection after each adjustment or repair, and at end of maintenance period. Submit completed inspection form to Owner.
2. Perform maintenance, including emergency callback service, during normal working hours.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Provide automatic entrance door assemblies capable of withstanding loads and thermal movements based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Delegating Design: Engage a qualified professional engineer, as defined in Section 014000 “Quality Requirements” to design automatic entrances.

C. Structural Performance: Automatic entrances shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to SE1/ASCE7.

1. Wind Loads: As indicated on Drawings.
2. Seismic Loads: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Operating Range: Minus 30 deg F (Minus 34 deg C) to 130 deg F (54 deg C).

F. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. of fixed entrance system area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.

G. Opening-Force Requirements for Egress Doors: Not more than 50 lbf (222 N) required to manually set door in motion in the direction of egress if power fails, and not more than 15 lbf (67 N) required to open door to minimum required width.

H. Closing-Force Requirements: Not more than 30 lbf required to prevent door from closing.

I. Entrapment Force Prevention:

1. Power-Operated Sliding Doors: Not more than 30 lbf required to prevent stopped door from closing.

J. Source Limitations: Obtain automatic entrance door assemblies through one source from a single manufacturer.

K. Power-Operated Door Standard: BHMA A156.10.

L. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency and marked for intended use.

2.2 SLIDING AUTOMATIC ENTRANCE ASSEMBLIES

A. General: Provide manufacturer's standard automatic entrances, including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.

B. Sliding Automatic Entrance:

1. Basis-of-Design Product: The design for sliding automatic entrance doors is based on Stanley Access Technologies; Dura-Storm 2000 Series sliding automatic entrances.
2. Configuration: Bi-parting-sliding doors.

a. Configuration: Two sliding leaves and two full sidelights.
b. Traffic Pattern: Two-way.
c. Emergency Breakaway Capability: Sliding leaves only.
d. Mounting: Between jambs.

2.3 COMPONENTS

A. Framing Members: Manufacturer's standard extruded aluminum reinforced as required to support imposed loads.

1. Nominal Size: 1-3/4 by 4-1/2 inches.
2. Concealed Fastening: Framing shall incorporate a concealed fastening pocket, and continuous flush insert cover, extending full length of each framing member.

B. Stile and Rail Doors: Manufacturer's standard 1-3/4-inch- thick glazed doors with minimum 0.125-inch- thick, extruded-aluminum tubular stile and rail members. Incorporate concealed tie-rods that span full length of top and bottom rails.

1. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
2. Stile Design: Medium stile; 3-1/2-inch nominal width.
3. Bottom Rail Design: Minimum 10 inch nominal height.
4. Muntin Bars: Horizontal tubular rail member for each door; 2-inch.

C. Glazing: Performed under Division 8 Section “Glazing” in accordance with product approvals and the following.

1. Glass: 9/16 inch laminated impact rated glass as specified in product approvals.

D. Headers: Fabricated from extruded aluminum and extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.

1. Mounting: Concealed, with one side of header flush with framing.
2. Capacity: Capable of supporting up to 220 lb per panel, up to four panels, over spans up to 14 feet without intermediate supports.

E. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment of at least 1/8 inch; consisting of urethane with precision steel lubricated ball-bearing wheels, operating on a continuous roller track. Support panels from

carrier assembly by load wheels and anti-riser wheels with factory adjusted cantilever and pivot assembly. Minimum two ball-bearing load wheels and two anti-rise rollers for each active leaf. Minimum load wheel diameter shall be 2 1/2 inch; minimum anti-rise roller diameter shall be 2 inch.

F. Thresholds: Manufacturer's standard thresholds as indicated below:

1. Continuous standard tapered extrusion double bevel.
2. Continuous standard square extrusion, for recessed installation.
3. Standard square extrusion track under sidelights, for recessed installation; no threshold under sliding opening.
4. All thresholds to conform to details and requirements for code compliance

G. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

H. Signage: Provide signage in accordance with ANSI/BHMA A156.10.

2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Headers, stiles, rails, and frames: 6063-T6.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Sheet and Plate: ASTM B 209.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: A 1011/A 1011M.

C. Sealants and Joint Fillers: As specified in Section 079200 "Joint Sealants."

D. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C 1107; of consistency suitable for application.

E. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos; formulated for 30-mil thickness per coat.

2.5 DOOR OPERATORS

A. General: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, operation under normal traffic load for type of occupancy indicated.

B. Electromechanical Operators: Self-contained overhead unit powered by a minimum of 1/4 horsepower, permanent-magnet DC motor with gear reduction drive, microprocessor controller; and encoder.

1. Operation: Power opening and power closing.
2. Features:

a. Adjustable opening and closing speeds.
b. Adjustable back-check and latching.
c. Adjustable braking.
d. Adjustable hold-open time between 0 and 30 seconds.
e. Obstruction recycle.
f. On/Off switch to control electric power to operator.
g. Energy conservation switch that reduces door-opening width.
h. Closed loop speed control with active braking and acceleration.
i. Adjustable obstruction recycle time delay.
j. Self adjusting stop position.
k. Self adjusting closing compression force.
l. Onboard sensor power supply.
m. Onboard sensor monitoring.
n. Optional Switch to open/Switch to close operation.

3. Mounting: Concealed.
4. Drive System: Synchronous belt type.

C. Electrical service to door operators shall be provided under Division 26 Electrical. Minimum service to be 120 VAC, 5 amps.

2.6 ELECTRICAL CONTROLS

A. Electrical Control System: Electrical control system shall include a microprocessor controller and a high-resolution position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position and speed.

1. The high-resolution encoder shall have a resolution of not less than 1024 counts per revolution. Systems utilizing external magnets and magnetic switches are not acceptable.
2. Electrical control system shall include a 24 VDC auxiliary output rated at 1 amp.

B. Performance Data: The microprocessor shall collect and store performance data as follows:

1. Counter: A non-resettable counter to track operating cycles.
2. Event Reporting: Unit shall include event and error recording including number of occurrences of events and errors, and cycle count of most recent events and errors.
3. LED Display: Display presenting the current operating state of the controller.

C. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:

1. Automatic Reset Upon Power Up.
2. Main Fuse Protection.
3. Electronic Surge Protection.
4. Internal Power Supply Protection.
5. Resetable sensor supply fuse protection.
6. Motor Protection, over-current protection.

D. Soft Start/Stop: A “soft-start” “soft-stop” motor driving circuit shall be provided for smooth normal opening and recycling.

E. Obstruction Recycle: Provide system to recycle the sliding panels when an obstruction is encountered during the closing cycle. If an obstruction is detected, the system shall search for that object on the next closing cycle by reducing door closing speed prior to the previously encountered obstruction location and will continue to close in check speed until doors are fully closed, at which time the doors will reset to normal speed. If obstruction is encountered again, the door will come to a full stop. The doors shall remain stopped until obstruction is removed and operate signal is given, resetting the door to normal operation.

F. Programmable Controller: Microprocessor controller shall be field programmable. The following parameters may be adjusted via the configuration tool.

1. Operating speeds and forces as required to meet ANSI/BHMA A156.10.
2. Adjustable and variable features as specified in 2.5, B., 2.
3. Reduced opening position.
4. Manual programming shall be available through local interface which has a two-digit display with a selection control including three push buttons.

2.7 ACTIVATION AND SAFETY DEVICES

A. Combined Activation and Safety Sensors: Combined activation and safety sensors shall, in a single housing, detect motion and presence in accordance with ANSI/BHMA A156.10. Motion shall be detected using K-band microwave technology, presence by active infrared reflection technology.

1. Mounting Height: Up to 11.5 feet above finish floor.
2. Temperature Range: Between -31°F and 131°F in all environmental conditions.
3. Relays: Form C, 50V at 0.3A for both activation and safety. Hold time of less than 0.5 seconds.
4. Detection Pattern: When detection is made in the activation zone, and the entrance opens, the safety zone shall extend through the threshold on each side; creating an X-pattern. When activation and safety zones are cleared and the entrance closes the sensor will ignore the X-pattern safety zones.
5. Combined motion and presence sensors shall be equal to or better than X-Zone Sensor by Optex.

B. Photoelectric Beams: In addition to the threshold sensor include a minimum of two (2) doorway holding beams. Photoelectric beams shall be pulsed infrared type, including sender receiver assemblies for recessed mounting.

C. Presence Sensor Monitoring: Sliding automatic entrances control system shall include a means to verify the functionality of all active presence sensors in accordance with ANSI/BHMA A156.10. A detected fault shall cause automatic operation to cease until the fault is corrected.

2.8 HARDWARE

A. General: Provide units in sizes and types recommended by automatic entrance door and hardware manufacturers for entrances and uses indicated.

B. Emergency Breakaway Feature: Provide release hardware that allows panel(s) to swing out in direction of egress to full 90 degrees from any position in sliding mode. Maximum force to open panel shall be 50 lbf (222 N) according to ANSI/BHMA A156.10. Interrupt powered operation of panel operator while in breakaway mode.

1. Emergency breakaway feature shall include at least one adjustable detent device mounted in the top of each breakaway panel to control panel breakaway force.
2. Wind Resistant Damper: Provide factory installed concealed gas dampers in sliding or non-sliding breakaway panels to protect door panels from wind damage. Dampers shall be designed to slow panel movement after breakout.

C. Locking: Manufacturer's approved multi-point locking system as follows.

1. Hook bolt: Laminated-steel hook, mortise type, operated by exterior cylinder and interior thumb turn; with minimum 1 inch long throw bolt; ANSI/BHMA A156.5, Grade 1."
2. Three-Point Locking: Provide locking components within sliding panel, operated by exterior cylinder and interior thumb turn, that extend flush bolts into overhead carrier assembly and threshold on engagement of hook bolt lock.
3. Cylinders: Provide lock cylinders by BEST Access Systems, with core and key.
4. Lock/Unlock Indicators: Provide lock position indicators integrated with locking system. Indicators shall be stile mounted on the secure side of the door and provide a visual display of lock position for; “OPEN” in black letters when unlocked, “LOCKED” in red letters when locked.
5. Armored Strike: Provide reinforced security strike plate on bi-parting entrances.

D. Panic Release Locking: Manufacturer's approved multi-point locking system with panic release hardware as follows:

1. Two-Point Locking: Provide locking components within sliding panel, including panic release hardware, that extend flush bolts into overhead carrier assembly and threshold of sliding leaf. Flush bolts shall be manually dogged, or disengaged, for normal operation. Lock cylinders shall be provided to allow for disengagement of flush bolts from the exterior.
2. Cylinders: Provide lock cylinders by BEST Access Systems, with core and key.
3. Panic release hardware shall be equal to or better than, Adams Rite G86-11-36.

E. Control Switch: Provide manufacturer’s standard header mounted rocker switches and door position switch to allow for full control of the automatic entrance door. Controls to include, but are not limited to:

1. One-way traffic.
2. Reduced Opening.
3. Open/Closed/Automatic.

F. Power Switch: Sliding automatic entrances shall be equipped with a two position On/Off rocker switch to control power to the door.

G. Sliding Weather Stripping: Manufacturer's standard replaceable components complying with AAMA 701; made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

1. Provide double pile weather stripping on lead stiles of sliding panels and stiles adjacent to jambs.

2. Provide single pile weather stripping between carrier and header, lead stiles of sidelights, and on pivot stiles of sliding panels.

H. Weather Sweeps: Manufacturer's standard adjustable nylon brush sweep mounted to underside of door bottom.

2.9 FABRICATION

A. General: Factory fabricate automatic entrance door assembly components to designs, sizes, and thicknesses indicated and to comply with indicated standards.

1. Form aluminum shapes before finishing.
2. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing.
    a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
    b. Reinforce members as required to receive fastener threads.
3. 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.

B. Framing: Provide automatic entrance doors as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.

1. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
3. Form profiles that are sharp, straight, and free of defects or deformations.
4. Prepare components to receive concealed fasteners and anchor and connection devices.
5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
6. Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
7. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.
8. Allow for thermal expansion of exterior units.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.

E. Welding: Comply with AWS A5.10/A5.10M - Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods.

F. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."

G. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.

1. Provide sliding weather stripping, mortised into door, at perimeter of sliding doors.

2.10 GENERAL FINISH REQUIREMENTS

A. General: 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. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.

D. 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.

2.11 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Color Anodic Finish: AA-M12C22A42/A44 Mechanical Finish: as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.70 mils minimum complying with AAMA 611-98, and the following:

1. Color: Dark bronze shall match storefront.
2. AAMA 606.1.
3. Applicator must be fully compliant with all applicable environmental regulations and permits, including wastewater and heavy metal discharge.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic entrance installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Do not install damaged components. Fit frame joints to produce joints free of burrs and distortion. Rigidly secure non-movement joints.

1. 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.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

B. Entrances: Install automatic entrance doors plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.

1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Level recesses for recessed thresholds using nonshrink grout.

C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 Sections.

D. Activation and Safety Devices: Install and adjust devices to provide detection field and functions indicated.

E. Glazing: Install glazing as specified in Section 088000 "Glazing."

F. Sealants: Comply with requirements specified in Section 079200 "Joint Sealants" to provide weathertight installation.

1. Set framing members, thresholds, bottom-guide track system, and flashings in full sealant bed.
2. Seal perimeter of framing members with sealant.

3.3 FIELD QUALITY CONTROL

A. Testing Services: Factory Trained Installer shall test and inspect each automatic entrance door to determine compliance of installed systems with applicable ANSI standards.

3.4 ADJUSTING

A. Adjust door operators, controls, and hardware for smooth and safe operation, for weathertight closure, and complying with requirements in BHMA A156.10.

B. Lubricate operating hardware and other moving parts.

3.5 CLEANING AND PROTECTION

A. Clean glass and aluminum surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.

1. Comply with requirements in Division 8 Section "Glazing" for cleaning and maintaining glass.

3.6 DEMONSTRATION

A. Engage a certified inspector to train Owner's maintenance personnel to adjust, operate and maintain automatic entrances.

END OF SECTION 084229.23

SECTION 085113 - 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. Section includes aluminum windows for exterior locations.

B. Related Requirements:

1. Section 084113 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.

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 construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.
2. Provide detailed data on manufacturers catalog data on each product to be used, including Miami Dade County Product Approval (NOA) and Florida Building Code (FBC) HVHZ Product Approval.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.

D. Samples for Initial Selection: For units with factory-applied color finishes.

1. Include similar Samples of hardware and accessories involving color selection.

E. Samples for Verification: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches.
2. Exposed Hardware: Full-size units.

F. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Comply with Florida Building Code Product Approval Notice of Acceptance.

E. Sample Warranties: For manufacturer's warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

C. 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 typical wall area as shown on Drawings.
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.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows 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, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Structural, Hardware and Certain Finishes: 10 years.
b. Stress Cracks on Glass: 1 year.
c. Delamination on Laminated Glass Units: 5 years.
d. Insulated Glass (sealed component): 10 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturers and Products:

1. Single Hung: Model SH360; Series 360 Aluminum Single Hung Window (L.M.I. and S.M.I.) by WinDoor, Inc.
2. Fixed Windows: Model PW238D; Series 238 Designer Fixed Windows by CGI Windows and Doors, Inc.

2.2 ALUMINUM WINDOWS

A. Single Hung Windows: Model SH360; Series 360 Estate Aluminum Single Hung Window (L.M.I. and S.M.I.) by WinDoor, Inc.

1. Example Sizes and Related Design Pressures: Refer to product approvals for latest results.
2. Air Infiltration Resistance: Air leakage no more than 0.52 cfm/sqft of glass area at pressure differential of 6.24 psf (air infiltration tests conducted at pressure differential of 1.57 psf may not be used to justify compliance).
3. Water Infiltration Resistance: No water penetration at a static air pressure differential of 15 percent of positive design pressure with maximum tested performance of 12 psf.
4. Construction: Extruded aluminum-alloy sections, precision cut and assembled with hairline joints.
5. Member Wall Thicknesses: Frames and Sash, 0.065 inch.
6. Frame Depth and Construction: At least 2.505 inches. Provide enclosed sill frame member. Provide 0.50 inch flanges at perimeter frames.

    a. Provide equal leg frames.

7. Sightlines:

    a. Head: 1.75 inches with flange frames and 1.25 inches with equal leg frames.
    b. Jambs: 2.846 inches with flange frames and 2.346 inches with equal leg frames.
    c. Meeting Rail: 2.819 inches.
    d. Sill (exterior): 3.875 inches with flange frames and 3.375 with equal leg frames.

8. Corner Construction: Assemble with sealed hairline joints, made rigid by fasteners with 3 #10 stainless steel screws per corner.
9. Glazing Beads: Extruded aluminum snap-in design, with 0.50 inch glass bite for impact-resistant glazing.
10. Weatherstripping: Wool pile with center soft fin (gray), minimum two rows at all moving connections. Third line of seal at sill with flexible PVB Bulb.
11. Finishes: Uniform at all visible surfaces exterior and interior.

    a. Color (RCB, Wellness): Bone White.
    b. Color (Clubhouse): Bermuda Bronze.

12. Factory Glazing:

    a. Insulated Laminated Impact Resistant Glass Units (3/4” Clear LoE 366): 3/4 inch thick (nominal) insulated laminated unit consisting of a sacrificial exterior lite and a clear, non-yellowing, non-crazing interlayer sandwiched between two panes of glass.

        1) Exterior Sacrificial Lites/Panes: 3/16 Inch.

a) Type: Heat Strengthened.
b) Tint in Outer Panes: None, clear.

2) Airspaces: 3/8 inch minimum air space.
3) Laminated Units:

a) Interlayer: .090" Saflex Clear and Color Glass by Eastman Chemical Co.
b) Outer and inner panes of laminated unit – 3/16 inch.
c) Type: Heat strengthened.
d) Tint: Low E.

4) Energy Values:

a) U Factor: 0.60.
b) SHGC: 0.23.
c) VT: 0.47.

13. Factory Glazing:

a. Insulated Laminated Impact Resistant Glass Units (3/4" Clear LoE 366): 3/4 inch thick (nominal) insulated laminated unit consisting of a sacrificial exterior lite and a clear, non-yellowing, non-crazing interlayer sandwiched between two panes of glass.

1) Exterior Sacrificial Lites/Panes: 3/16 Inch.

a) Type: Tempered.
b) Tint in Outer Panes: None, clear.

2) Airspaces: 3/8 inch minimum air space.
3) Laminated Units:

a) Interlayer: .090" Saflex Clear and Color Glass by Eastman Chemical Co.
b) Outer and inner panes of laminated unit – 3/16 inch.
c) Glass Type Outer Pane: Heat strengthened.
d) Glass Type Inner Pane: Tempered.
e) Tint: Low E.

4) Energy Values:

a) U Factor: 0.60.
b) SHGC: 0.23.
c) VT: 0.47.

14. Mullions:

a. Basis of Design Manufacturer and Product:

1) Manufacturer: CGI Doors and Windows, Inc.
2) Product: Unclipped Mullion; Series 360 Sentinel Unclipped Mullions, L.M.I.

15. Hardware: Factory applied, and field adjusted.

a. Balances: Attached to an independent carrier with nylon guides for smooth operation and sash removal feature without disengaging the balance.

1) Balance Type: Concealed block and tackle balances.

b. Head covers for installation screws.
c. Combination Egress Self Closing Lock and Lift/Pull: Spring loaded.

1) Quantity: One per window, standard.

16. Window Accessories:
    a. Screens: Charcoal fiberglass insect screen fabric, tightly splined into extruded aluminum-alloy frames with rigid corner construction.
    b. Low Profile with GBG with insulated glass as indicated on the drawings.
    c. Limit opening device.
    d. Meeting Rail Mounted Sweep Lock:
        1) Quantity: One per window, standard.
17. Aluminum Alloy and Temper: AA 6063-T5 and T6 temper; ASTM B 221M.
18. Comply with Florida Building Code Product Approval Notice of Acceptance.

B. Fixed Windows: Model PW238D; Series 238 Estate Designer Fixed Windows – L.M.I. by CGI Windows and Doors, Inc.
1. Fixed Window Types: Rectangular Fixed Windows; for example sizes and related design pressures refer to product approvals for latest results.
2. Air Infiltration Resistance: Air leakage no more than 0.08 cfm/sqft of glass area at pressure differential of 6.24 psf (air infiltration tests conducted at pressure differential of 1.57 psf may not be used to justify compliance).
3. Water Infiltration Resistance: No water penetration at a static air pressure differential of 15 percent of positive design pressure with maximum tested performance of 12 psf.
4. Construction: Heavy extruded aluminum-alloy sections, precision cut and assembled with sealed, hairline joints.
5. Member Wall Thicknesses: Rectangular and Designer window fixed frames, at least 0.065 inch.
6. Frame Depth: Rectangular and Designer fixed windows frames: At least 2.505 inches. Provide 0.50 inch flanges at perimeter frames.
    a. Provide equal leg adaptor frames.
    b. Provide fin adaptor frames.
    c. Provide flange adaptor frames.
7. Sightlines for Rectangular and Designer Fixed: Jambs, sill and head - 2 inches for flange frames and 1.5 inches for equal leg frames.
8. Corner Construction Rectangular Fixed Window Frames: Assemble with sealed, squared, hairline joints, made rigid by fastening with No. 10 stainless steel screws.
9. Corner Construction at Designer Fixed Window Frames: Welded corners with sealed hairline joints.
10. Glazing Beads: Extruded aluminum snap-in design, with 0.75 inch glass bite for impact-resistant glazing at rectangular fixed windows
11. Finishes: Uniform at all visible surfaces exterior and interior.
    a. Color (RCB, Wellness): Bone White.
    b. Color (Clubhouse): Bermuda Bronze.
12. Factory Glazing:
    a. Insulated Laminated Impact Resistant Glass Units (1” Clear LoE 366): 1 inch thick (nominal) consisting of a sacrificial exterior lite and a clear, non-yellowing, non-crazing interlayer sandwiched between two panes of glass.
        1) Exterior sacrificial Lites/Panes: 3/16 inch tempered.
        2) Tint in Outer Panes: None, clear.
        3) Airspace: 3/8 inch minimum air space.
        4) Energy advantage, Low E and high performance glass coatings as indicated on Drawings.
        5) Laminated Units: Consisting of clear, non-yellowing, non-crazing interlayer sandwiched between two panes of glass.

a) Interlayer: .090” Saflex Clear and Color Glass by Eastman Chemical Co.
b) Outer and Inner Panes of Laminated Units: 3/16 inch.
c) Type: Tempered.
d) Tint: Clear, Low E.

6) Energy Values:

a) U Factor: 0.42.
b) SHGC: 0.25.
c) VT: 0.53.

13. Window Accessories: As indicated on the drawings.

a. GBG (Grill Between Glass).
b. Low Profile with GBG with insulated glass.

14. Standards: Comply with Florida Building Code Product Approval Notice of Acceptance.
15. Aluminum Alloy and Temper: AA 6063-T5 and T6 temper.

2.3 ACCESSORIES

A. Restrictive Devices: Provide manufacturers standard restrictive devices at all operable windows.

2.4 SPRAY POLYURETHANE INSULATING FOAM SEALANT

A. Closed-Cell Polyurethane Foam Insulation: ASTM 16, Type II, with maximum flame-spread and smoke-developed indexes of 10 and 20, respectively, per ASTM E 84.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Dow Chemical Company (The); Great Stuff Pro Window and Door Insulating Foam Sealant.

2. Minimum density of 1.5 lb/cu.ft.

2.5 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design wind loads of window units.

G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" 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: 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.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. AAMA 2603 ESP Finishes: Pretreatment plus 1 coat ESP Siliconized Polyester Coating.

1. Color. Manufacturer’s standard bronze color.

C. AAMA 2605 Kynar Finish: Pretreatment plus 2 coat, 70 percent polyvinylidene fluoride (PVDF) coating, or manufacturer approved equal.

1. Color: As indicated elsewhere in this section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions and Florida Building Code Product Approval/ Notice of Acceptance requirements for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

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 to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

E. Install insulating foam sealant in void between window unit and rough-in framing.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner reserves the right to 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: Mockup 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. Remove and replace noncomplying windows and retest as specified above.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 085113

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This Section includes the following:
1. Hinges
2. Continuous hinges
3. Key control system
4. Lock cylinders and keys
5. Lock and latch sets
6. Bolts
7. Exit devices
8. Push/Pull units
9. Closers
10. Overhead holders
11. Miscellaneous door control devices
12. Door trim units
13. Protection plates
14. Weatherstripping for exterior doors
15. Sound stripping for interior doors
16. Automatic drop seals (door bottoms)
17. Astragals or meeting seals on pairs of doors
18. Thresholds

C. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 07 9200: Joint Sealants
2. Section 08 1113: Hollow Metal Doors and Frames
3. Section 08 1400: Wood Doors
4. Section 28 1300: Access Control

D. Products furnished but not installed under this Section to include:
1. Cylinders for locks on entrance doors.

1.3 REFERENCES

A. Standards of the following as referenced:
1. American National Standards Institute (ANSI)
2. Door and Hardware Institute (DHI)
3. Factory Mutual (FM)
4. National Fire Protection Association (NFPA)

5. Underwriters' Laboratories, Inc. (UL)
   a. UL 10C - Fire Tests Door Assemblies
6. Warnock Hersey

B. Regulatory standards of the following as referenced:
1. Department of Justice, Office of the Attorney General, *Americans with Disabilities Act*, Public Law 101-336 (ADA).
2. CABO/ANSI A117.1: *Providing Accessibility and Usability for Physically Handicap People*, 1992 edition.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.

B. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements. For items other than those scheduled in the Headings of Section 3, provide catalog information for the specified items and for those submitted.

C. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into vertical format "hardware sets" indicating complete designations of every item required for each door or opening. Use specification Heading numbers with any variations suffixed a, b, etc. Include the following information:
   a. Type, style, function, size, and finish of each hardware item.
   b. Name and manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of each hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
   e. Explanation of all abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for hardware.
   g. Door and frame sizes and materials.
   h. Keying information.
   i. Cross-reference numbers used within schedule deviating from those specified.
      1) Column 1: State specified item and manufacturer.
      2) Column 2: State prior approved substituted item and its manufacturer.
2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
3. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

D. Samples of each type of exposed hardware unit in finish indicated and tagged with full description for coordination with schedule. Submit samples prior to submission of final hardware schedule.
1. Samples will be returned to the supplier. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final

check of operation, be incorporated in the Work, within limitations of keying coordination requirements.

E. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

F. Contract closeout submittals:
1. Operation and maintenance data: Complete information for installed door hardware.
2. Warranty: Completed and executed warranty forms.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced detailer who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
1. Require supplier to meet with Owner to finalize keying requirements and to obtain final instructions in writing.
2. Require supplier to meet with installer prior to beginning of installation of door hardware.

C. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not. All hardware shall comply with standards UBC 7-2 (1997) and UL 10C.
1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors UL labels indicating Fire Door to be equipped with Fire Exit Hardware) provide UL label on exit devices indicating Fire Exit Hardware.

1.6 PRODUCT HANDLING

A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.

C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).

E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.7 WARRANTY

A. Special warranties:
1. Hinges: Lifetime
2. Door Closers: Twenty-five year period
3. Exit Devices: Ten year period
4. Automatic Door Operators: Two year period
5. Locks and Cylinders: Lifetime

1.8 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Parts kits: Furnish manufacturers' standard parts kits for locksets, exit devices, and door closers.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS
(* Denotes manufacturer referenced in the Hardware Headings)

A. Hinges:
1. Acceptable manufacturers:
a. Bommer
b. Hager Hinge Company
c. PBB*
2. Characteristics:
a. Templates: Provide only template-produced units.
b. Screws: Provide Phillips flat-head screws complying with the following requirements:
1) For metal doors and frames install machine screws into drilled and tapped holes.
2) For wood doors and frames install threaded-to-the-head wood screws.
3) For fire-rated wood doors install #12 x 1-1/4 inch, threaded-to-the-head steel wood screws.
4) Finish screw heads to match surface of hinges or pivots.
c. Hinge pins: Except as otherwise indicated, provide hinge pins as follows:
1) Out-Swing Exterior Doors: Non-removable pins.
2) Out-Swing Corridor Doors with Locks: Non-removable pins.
3) Interior Doors: Non-rising pins.
4) Tips: Ball tips. Finished to match leafs.
d. Size: Size hinges in accordance with specified manufacturer’s published recommendations.
e. Quantity: Furnish one pair of hinges for all doors up to 5'0" high. Furnish one hinge for each additional 2-1/2 feet or fraction thereof.

B. Continuous Hinges:
1. Acceptable manufacturers:
a. Bommer
b. PBB
c. Select Products*
2. Characteristics:
a. Continuous gear hinges to be manufactured of extruded 6063-T6 aluminum alloy with anodized finish, or factory painted finish as scheduled.
b. All hinges are to be manufactured to template. Uncut hinges shall be non-handed and shall be a pinless assembly of three interlocking extrusions applied to the full height of the door and frame without mortising.
c. Vertical door loads shall be carried on chemically lubricated polyacetal thrust bearings. The door and frame leaves shall be continually geared together for the entire hinge length and secured with a full cover channel. Hinge to operate to a full 180°.
d. Hinges to be milled, anodized and assembled in matching pairs. Fasteners supplied shall be 410 stainless steel, plated and hardened.
e. Provide UL listed continuous hinges at fire doors. Continuous hinges at fire doors (suffix -FR) shall meet the required ratings without the use of auxiliary fused pins or studs.

C. Cylinders:
1. Acceptable manufacturers:
a. Key into Owner's existing key system
2. Characteristics:
a. Cores and Keys will be stamped with applicable key mark for identification. This key mark will not include the actual key cuts.
b. Pemanent keys will be stamped with a word or phrase which will visually identify them as patented or restricted from duplication.
c. Permanent cores and keys shall either be delivered through secure Mail, or picked up by the Owner's Representative.
d. Permanent core shall be keyed by the manufacturer, combinated in sets master keyed or grand master keyed as directed by the Owner. Permanent keys and cores shall be stamped with the applicable key mark for identification. Permanent keys will also be stamped “DO NOT DUPLICATE”. Key and core identification stamping to be approved by the Owner. Failure to properly comply with these requirements may be cause to require replacement of all or any part of the cylinders and keys involved a deemed necessary at no additional cost to the Owner.
e. Equip locks with cylinders for interchangeable-core pin tumbler inserts. Furnish only temporary inserts for the construction period, and remove these when directed.
f. Furnish final cores and keys for installation by Owner.
g. Comply with Owner's instructions for master keying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.
1) Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE."
h. Key Quantity: Furnish 3 change keys for each lock. This system will consist of a Grandmaster, Masters, Sub-Masters, Operating and Control keys.
1) Deliver keys to Owner.

i. Provide Owner or its designated representative, with a copy of all keying codes associated with the system.
j. Provide the Owner with all Service Equipment and Booklets required to properly maintain system equipment and hardware.
k. Provide a consultant, which shall be available to the Owner during normal work hours.

D. Locksets, Latchsets, Deadbolts:
1. Acceptable manufacturers:
a. Frascio*
b. Schlage
c. Yale
2. Mortise Locksets and Latchsets: as scheduled.
a. Chassis: cold-rolled steel, handing field-changeable without disassembly.
b. Latchbolts: 3/4-inch throw stainless steel anti-friction type.
c. Lever Trim: through-bolted, accessible design, as scheduled.
d. Spindles: independent break-away.
e. Thumbturns: accessible design not requiring pinching or twisting motions to operate.
f. Deadbolts: stainless steel 1-inch throw.
g. Electric operation: Manufacturer-installed continuous duty solenoid.
h. Strikes: 16 gage curved stainless steel, bronze or brass with 1" deep box construction, lips of sufficient length to clear trim and protect clothing.
i. Scheduled Lock Series and Design: Frascio M500 Series, design to be selected by Design Professional.
j. Certifications:
1) ANSI A156.13, 1994, Grade 1 Operational, Grade 2 Security.
2) ANSI/ASTM F476-84 Grade 30 UL Listed.
3. Tubular Latchsets: as scheduled
a. Latch case: one-piece with heavy duty springs and stainless steel plunger.
b. Hubs: separate hubs for independent operation of levers.
c. Strikes: T-Strike.
d. Levers: to match mortise locks above.
4. Access control Locksets: as scheduled
a. Acceptable manufacturer: Salto Mini, with lever design to match balance of locks and latches on the Project.
5. Deadbolts: as scheduled. Rotating cylinder trim rings of attack-resistant design. Mounting plates and actuator shields of plated cold-rolled steel. Mounting screws of 1/4" dia. steel and protected by drill-resistant ball bearings. Steel alloy deadbolt with hardened steel roller. Strike with 1/8" thick strike reinforcer and two 3" long screws. ANSI A156.5, 1992 Grade 1 certified.

E. Exit Devices:
1. Acceptable manufacturers:
a. Precision
b. Security Door Controls*
c. Von Duprin 98 Series*
2. Characteristics:
a. Exit devices shall be "UL" listed for life safety. All exit devices for fire rated openings shall have "UL" labels for "Fire Exit Hardware."
b. Exit devices mounted on labeled wood doors shall be thru-bolted mounted on the door per the door manufacturer’s requirements.

c. Trim shall be thru-bolted to the lock stile case.
d. Exit devices shall be made of brass, bronze, stainless steel, or aluminum material, plated, anodized, or powder coated to the standard architectural finishes to match the balance of the door hardware.
e. Provide glass bead conversion kits to shim exit devices on doors with raised glass beads.
f. Exit devices shall be one manufacturer. No deviation will be considered.
g. Exit devices shall be non-handed. Touchpad shall extend a minimum of 1/2 of the door width and shall be a minimum of 2-3/16" in height. Plastic touchpads are not acceptable. Latchbolts to be the deadlocking type. Latchbolts shall have a self-lubricating coating to reduce wear. Plated or plastic coated latchbolts are not acceptable. Plastic linkage and “dogging” components are not acceptable.
h. When removable mullions are listed, provide the type controlled by key cylinder under the master key system (keyed removable mullion). Keyed cores are to be provided with removable mullions.
i. Surface vertical rod devices shall be UL labeled for fire door applications without the use of bottom rod assemblies. Where bottom rods are required for security applications, the devices shall be UL labeled for fire doors applications with rod and latch guards by the device manufacturer.

F. Closers and Door Control Devices:
1. Acceptable manufacturers:
a. Dorma
b. LCN Closers 1460/4040 Series
c. Yale
d. Security Door Controls* (automatic operator only)
2. Characteristics:
a. Door closers shall be mounted and installed with thru bolts according to manufacturer instructions.
b. Door closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder.
c. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UBC 7-2 (1997) and UL 10C.
d. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed and back check.
e. Closers shall have solid forged steel main arms (and forearms for parallel arm closers) and where specified shall have a cast-in solid stop on the closer shoe ("DS"). Auxiliary stops are not required when these type closers are used.
f. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped. Provide adjustable units complying with ADA and ANSI A-117.1 provisions for door opening force.
g. Closers to be installed to allow door swing as shown on plans. Doors swinging into exit corridors shall provide for corridor clear width as required by code. Where possible, mount closers inside rooms.

G. Overhead Door Holders:
1. Acceptable manufacturers:
a. ABH Manufacturing*
b. Rixson Firemark

2. Characteristics:
   a. Provide heavy duty and medium duty door holders surface mounting of brass, bronze or stainless steel.
   b. Surface holders to be installed with the jamb bracket mounted on the stop.

H. Floor Stops and Wall Bumpers:
1. Acceptable manufacturers:
   a. Burns*
   b. Hager
   c. Trimco
2. Characteristics: Refer to Hardware Headings.

I. Door Bolts/Coordinators:
1. Acceptable manufacturers:
   a. Burns*
   b. Hager
   c. Trimco
2. Characteristics:
   a. Flush bolts to be forged brass 6-3/4" x 1", with 1/2" diameter bolts. Plunger to be supplied with milled surface one side that fits into a matching guide.
   b. Automatic flush bolts to be UL listed as top and bottom bolts on a pair of classified fire doors. Bolt construction to be of rugged steel and brass components.
   c. Self-latching flush bolts to be UL listed as top and bottom bolts on a pair of classified fire doors. Bolt construction to be of rugged steel and brass components.
   d. Coordinator to be soffit mounted non-handed fully automatic UL listed coordinating device for sequential closing of paired doors with or without astragals.
   e. Provide filler piece to close the header. Provide brackets as required for mounting of soffit-applied hardware.

J. Push Plates:
1. Acceptable manufacturers:
   a. Burns*
   b. Hager
   c. Trimco
2. Characteristics:
   a. Exposed Fasteners: Provide manufacturers standard exposed fasteners.
   b. Material to be wrought stainless steel, per the Hardware Headings.
   c. Provide plates sized as shown in Hardware Headings.

K. Door Pulls & Pull Plates:
1. Acceptable manufacturers:
   a. Burns*
   b. Hager
   c. Trimco
2. Characteristics:
   a. Provide concealed thru-bolted trim on back to back mounted pulls, but not for single units.
   b. Material to be extruded forged/ cast, brass/ bronze/ aluminum/ stainless steel.
   c. Provide units sized as shown in Hardware Headings.

L. Push Pull Sets:
1. Acceptable manufacturers:
a. Burns*
b. Hager
c. Trimco
2. Characteristics:
a. Provide mounting systems as shown in hardware sets.
b. Material to be stainless steel.
c. Provide Push/Pull sets sized as shown in Hardware Headings.

M. Protective Plates:
1. Acceptable manufacturers:
a. Burns*
b. Hager
c. Trimco
2. Characteristics:
a. Provide manufacturers standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.
b. Materials:
1) Metal Plates: Stainless Steel, .050 inch (U.S. 18 gage).
c. Fabricate protection plates not more than 2 inches less than door width on hinge side and not more than 1 inch less than door width on pull side.
d. Heights:
1) Kick plates to be 8 inches in height.
2) Mop plates to be 4 inches in height.
3) Armor plates to be 30 inches in height. Armor plates on fire doors to comply with NFPA 80.

N. Thresholds:
1. Acceptable manufacturers:
a. National Guard Products, Inc.
b. Silguard*
c. Zero Weatherstripping Co., Inc.
2. Types: Indicated in Hardware Headings.

O. Door Seals/Gasketing:
1. Acceptable manufacturers:
a. National Guard Products, Inc.*
b. Reese Industries
c. Zero Weatherstripping Co., Inc.
2. Types: Indicated in Hardware Headings.

P. Silencers:
1. Acceptable manufacturers:
a. Burns*
b. Hager
c. Trimco
2. Three for each single doors; four for pairs of doors.

Q. Magnetic Door Holders:
1. Acceptable manufacturers:

a. LCN
b. Rixson-Firemark
c. Security Door Controls*

2. Wall-mounted 24VDC units with finish to match door hardware.

R. Miscellaneous Hardware:
1. Acceptable manufacturers:
a. Johnson Hardware* (sliding door hardware only)
b. Richelieu* (sliding door hardware only)
2. Characteristics: As described in Hardware Headings.

S. Key Cabinet and System:
1. Acceptable manufacturers:
a. Telkee, Inc.
2. Provide a key control system including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150 percent of the number of locks required for the Project.
a. Provide complete cross index system set up by key control distributor, and place keys on markers and hooks in the cabinet as determined by the final key schedule.
b. Provide hinged-panel type cabinet for wall mounting.

2.2 MATERIALS AND FABRICATION

A. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

B. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
1. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated. Self-tapping screws are not an acceptable installation method.
2. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
3. Coordinate with wood doors and metal doors and frames where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt fastener.

2.3 HARDWARE FINISHES

A. Match items to the manufacturer’s standard color and texture finish for the latch and lock sets (or push-pull units if no latch or lock sets).

B. Provide finishes that match those established by ANSI or, if none established, match the

Architect’s sample.

C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer’s standards, but in no case less than specified by referenced standards for the applicable units of hardware.

D. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer."

E. The designations used to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.
1. Hinges (Interior doors): 619 (US15) Satin Nickel
2. Continuous Hinges: 628 (US28) Clear Anodized Aluminum, unless noted otherwise
3. Mortise Locks and Tubular Latches: 619 (US15) Satin Nickel
4. Exit Devices: 628 (US28) chassis, 689 (powder coated) or plated to match adjacent hardware covers, and 630 (US32D) touchpads
5. Door Closers: Powder Coat to match adjacent hardware
6. Push-Pull sets: 630 (US32D) Satin Stainless Steel
7. Protective Plates: 630 (US32D) Satin Stainless Steel
8. Door Stops: 626 (US26D) Satin Chrome Plated Brass/Bronze
9. Overhead Holders: 630 Satin Stainless Steel and 689 Powder Coated Steel (as scheduled)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Where both floor stops and wall stops are specified in headings, select the proper stop based upon conditions at each opening in that heading. Use a floor stop only when conditions would prohibit using a wall stop.

F. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Section 07 9200 Joint Sealers.

G. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.2 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to function properly with final operation of heating and ventilating equipment.

B. Clean adjacent surfaces soiled by hardware installation.

C. Door Hardware Supplier's Field Service
1. Inspect door hardware items for correct installation and adjustment after complete installation of door hardware.
2. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.
3. File written report of this inspection to Architect.

D. Prior to project completion, representatives of the lock, exit device and overhead closer manufacturers shall inspect and adjust all units and certify that all units are installed in accordance with the manufacturer’s instructions, and are regulated properly and functioning correctly. A written report shall be provided to the Architect as to the inspection and shall include appropriate certificates.

3.3 HARDWARE SCHEDULE

HEADING #AC1

EXTERIOR ACCESS CONTROL

EACH PAIR TO HAVE:

1	CONTINUOUS HINGE	
1	CONTINUOUS HINGE	WITH POWER TRANSFER
2	MAGLOCKS	WITH DPS AND BOND SENSOR
1	ACCESS CONTROL	SECTION 281300
1	POWER SUPPLY	
1	CLOSER	WITH STOP

NOTE: BALANCE OF HARDWARE BY DOOR MANUFACTURER
COORDINATE INSTALLATION OF SECURITY HARDWARE WITH ELECTRICAL AND SECURITY SYSTEMS

HEADING #AC2

EXTERIOR ACCESS CONTROL PAIRS WITH OPERATOR

EACH PAIR TO HAVE:

2	CONTINUOUS HINGES	WITH POWER TRANSFER
1	ELECTRIC EXIT DEVICE	LATCH RETRACTION EXIT ONLY
1	ELECTRIC EXIT DEVICE	LATCH RETRACTION WITH REQUEST TO EXIT NIGHT LATCH
1	ACCESS CONTROL	SECTION 281300 AND LV DRAWINGS
1	POWER SUPPLY	
1	OPERATOR	CONCEALED DUAL
2	ACTUATORS	
2	PULLS	DECORATIVE TO BE SELECTED BY DESIGN TEAM
2	KICKPLATES	
1	THRESHOLD	SILGUARD
1	SET DOOR SEALS	
2	DOOR BOTTOM SEALS	

NOTE: COORDINATE INSTALLATION OF SECURITY HARDWARE WITH ELECTRICAL AND SECURITY SYSTEMS
COORDINATE INSTALLATION OF OPERATOR WITH ELECTRICAL AND SECURITY SYSTEMS

HEADING #AC3

EXTERIOR ACCESS CONTROL OPENINGS

EACH DOOR TO HAVE:

1	CONTINUOUS HINGE	WITH POWER TRANSFER
1	MORTISELOCKSET	WITH REQUEST TO EXIT
1	ELECTRIC STRIKE	
1	POWER SUPPLY	
1	OPERATOR	CONCEALED SINGLE
2	ACTUATORS	
1	KICKPLATE	
1	THRESHOLD	SILGUARD
1	SET DOOR SEALS	
1	DOOR BOTTOM SEAL	

NOTE: COORDINATE INSTALLATION OF SECURITY HARDWARE WITH ELECTRICAL AND SECURITY SYSTEMS
COORDINATE INSTALLATION OF OPERATOR WITH ELECTRICAL AND SECURITY SYSTEMS

HEADING #AC4

INTERIOR PUSH-PULL OPENINGS WITH OPERATOR

EACH DOOR TO HAVE:

3	HINGES	HEAVY WEIGHT BALL BEARING
1	PUSH-PULL SET	SELF ATTACHING
1	OPERATOR	CONCEALED SINGLE
2	ACTUATORS	
1	KICKPLATE	
1	MOP PLATE	
1	DOOR STOP	WALL

NOTE: COORDINATE INSTALLATION OF OPERATOR WITH ELECTRICAL AND SECURITY SYSTEMS

HEADING #M1

ELECTRICAL HIGH HAZARD

EACH DOOR TO HAVE:

3	HINGES	BALL BEARING
1	EXIT DEVICE	STOREROOM FIRE RATED
1	CLOSER	WITH STOP
1	KICKPLATE	
1	DOOR STOP	WALL
1	SET DOOR SEALS	TRIPLE FIN ADHESIVE

HEADING #M2

RATED MECHANICAL PAIRS

EACH PAIR TO HAVE:

6	HINGES	BALL BEARING
1	SET FLUSHBOLTS	AUTOMATIC
1	COORDINATOR	BAR TYPE
1	MORTISE LOCKSET	SALTO XS4
2	CLOSERS	WITH STOP
2	KICKPLATES	
1	SET DOOR SEALS	TRIPLE FIN ADHESIVE

HEADING #M3

RATED INTERIOR DOORS

EACH DOOR TO HAVE:

3	HINGES	BALL BEARING
1	LOCKSET	SALTO XS4
1	CLOSER	
1	KICKPLATE	
1	DOOR STOP	WALL
1	SET DOOR SEALS	TRIPLE FIN ADHESIVE

HEADING #M4

EXTERIOR MECHANICAL DOORS

EACH DOOR TO HAVE:

1	CONTINUOUS HINGE	
1	LOCKSET	SALTO XS4
1	CLOSER	WITH HOLDOPEN AND STOP
1	KICKPLATE	
1	THRESHOLD	SILGUARD
1	SET DOOR SEALS	BULB SILICONE
1	DOOR BOTTOM SEAL	SILICONE
1	DRIP CAP	

HEADING #M5

EXTERIOR MECHANICAL PAIRS

EACH PAIR TO HAVE:

2	CONTINUOUS HINGES	
1	SET FLUSHBOLTS	MANUAL
1	MORTISE LOCKSET	SALTO XS 4
2	CLOSERS	WITH HOLDOPEN AND STOP
2	KICKPLATES	
1	THRESHOLD	SILGUARD
1	SET DOOR SEALS	BULB SILICONE
2	DOOR BOTTOM SEALS	SILICONE
1	DRIP CAP	

HEADING #P1

CORRIDOR DOORS

EACH PAIR TO HAVE:

6	HINGES	BALL BEARING
2	EXIT DEVICES	CONCEALED VERTICAL ROD EXIT ONLY LESS BOTTOM ROD
2	CLOSERS	
4	KICKPLATES	
2	MAGHOLDERS	SEMI-FLUSH
1	SET DOOR SEALS	TRIPLE FIN ADHESIVE
1	ASTRAGAL SEAL	ADHESIVE

NOTE: COORDINATE INSTALLATION OF MAGHOLDERS WITH ELECTRICAL AND FIRE SYSTEMS

HEADING #P2

AMENITY/FUNCTION SPACES

EACH PAIR TO HAVE:

6	HINGES	BALL BEARING
1	SET FLUSHBOLTS	
1	DEADLOCK	MORTISE
2	PULLS	DECORATIVE TO BE SELECTED BY DESIGN TEAM
2	CLOSERS	CONCEALED
2	KICKPLATE	
2	DOOR STOPS	

HEADING #P3

SINGLE LOCKING DOORS

EACH DOOR TO HAVE:

3	HINGES	BALL BEARING
1	LOCKSET	
1	DOOR STOP	

HEADING #P4

ELEVATOR LOBBY PAIRS

EACH PAIR TO HAVE:

6	HINGES	BALL BEARING
1	COORDINATOR	BAR TYPE
1	SET FLUSHBOLTS	AUTOMATIC
1	PASSAGE SET	
2	CLOSERS	
2	MAGHOLDERS	

NOTE: COORDINATE INSTALLATION OF MAGHOLDERS WITH ELECTRICAL AND FIRE SYSTEMS

HEADING #P5

RATED INTERIOR LOCKING DOORS

EACH DOOR TO HAVE:

3	HINGES	BALL BEARING
1	LOCKSET	SALTO XS 4
1	CLOSER	
1	KICKPLATE	
1	DOOR STOP	WALL
1	SET DOOR SEALS	TRIPLE FIN ADHESIVE

HEADING #R1

SINGLE TOILETS

EACH DOOR TO HAVE:

3	HINGES	BALL BEARING
1	PRIVACY SET	CYLINDRICAL
1	OPERATOR	CONCEALED SINGLE
2	ACTUATORS	
1	DOOR STOP	WALL
1	MOP PLATE	
1	COAT HOOK	DECORATIVE

NOTE: COORDINATE INSTALLATION OF OPERATOR WITH ELECTRICAL AND FIRE SYSTEMS

HEADING #S1

INTERIOR STAIRWELL DOORS

EACH DOOR TO HAVE:

3	HINGES	BALL BEARING
1	EXIT DEVICE	FIRE RATED PASSAGE
1	CLOSER	
1	KICKPLATE	
1	DOOR STOP	WALL
1	SET DOOR SEALS	TRIPLE FIN ADHESIVE
1	DOOR BOTTOM SEAL	

HEADING #S2

EXTERIOR STAIRWELL DOORS

EACH DOOR TO HAVE:

1	CONTINUOUS HINGE	
1	EXIT DEVICE	EXIT ONLY
1	CLOSER	WITH STOP
1	KICKPLATE	
1	THRESHOLD	SILGUARD
1	SET DOOR SEALS	
1	DOOR BOTTOM SEAL	

HEADING #T1

INDEPENDENT LIVING RESIDENT ENTRY

EACH DOOR TO HAVE:

3	HINGES	BALL BEARING
1	LOCKSET	
1	CLOSER	
1	KICKPLATE	
1	DOOR STOP	WALL
1	SET DOOR SEALS	TRIPLE FIN ADHESIVE
1	DOOR BOTTOM SEAL	NOTCHED FIN
1	VIEWER	2 @ ACCESSIBLE UNITS

HEADING #T2

MEMORY CARE RESIDENT ENTRY

EACH DOOR TO HAVE:

3	HINGES	BALL BEARING
1	PASSAGE SET	
1	CLOSER	
1	KICKPLATE	
1	DOOR STOP	WALL
1	SET DOOR SEALS	TRIPLE FIN ADHESIVE
1	DOOR BOTTOM SEAL	NOTCHED FIN
1	VIEWER	2 @ ACCESSIBLE UNITS

HEADING #T3

UNIT BATH/BEDROOM

EACH DOOR TO HAVE:

3	HINGES	PLAIN BEARING
1	PRIVACY SET	
1	DOOR STOP	BASE

HEADING #T4

UNIT CLOSET

EACH DOOR TO HAVE:

3	HINGES	PLAIN BEARING
1	PASSAGE SET	
1	DOOR STOP	BASE/HINGE PIN (AS CONDITIONS REQUIRE)

HEADING #T5

UNIT POCKET

EACH POCKET DOOR TO HAVE:

1	SET SLIDING DOOR HDW	SEE INTERIOR DRAWINGS WITH SOFT CLOSE
1	PRIVACY SET	SEE DRAWINGS

HEADING #T6

UNIT POCKET

EACH POCKET DOOR TO HAVE:

1	SET SLIDING DOOR HDW	SEE INTERIOR DRAWINGS WITH SOFT CLOSE
1	SET PULLS	SEE DRAWINGS

HEADING #T7

UNIT LAUNDRY/CLOSET

EACH PAIR DOORS TO HAVE:

6	HINGES	PLAIN BEARING
2	ROLLER CATCHES	
2	DUMMY TRIM	SINGLE
2	STOPS	HINGE PIN

HEADING #T8

UNIT BARN DOOR

EACH DOOR TO HAVE:

1	SET SLIDING DOOR HDW	SEE INTERIOR DRAWINGS WITH SOFT CLOSE
1	SET PULLS	BACK-TO-BACK

END OF SECTION

SECTION 087113 - AUTOMATIC DOOR OPERATORS

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. Low-energy door operators for swinging doors.

B. Related Sections:

1. Section 084229 "Automatic Entrances" for sliding, swinging, and folding entrances packaged with automatic door operators.

1.3 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.

C. Double-Egress (Doors): A pair of doors that simultaneously swing with the two doors moving in opposite directions with no mullion between them.

D. Double-Swing (Doors): A pair of doors that swing with the two doors moving in opposite directions with a mullion between them; each door functioning as a single-swing door.

E. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.

F. For automatic door terminology, see BHMA A156.10 for definitions of terms.

1.4 COORDINATION

A. Coordinate sizes and locations of recesses in concrete floors for recessed control mats that control automatic door operators. Concrete, reinforcement, and formwork requirements are specified elsewhere.

B. Templates: Distribute for doors, frames, and other work specified to be factory prepared and reinforced for installing automatic door operators.

C. Coordinate hardware for doors with operators to ensure proper size, thickness, hand, function, and finish.

D. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to power supplies and access-control system.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators, including activation and safety devices. Include operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For automatic door operators. Include plans, elevations, sections, details, and attachments to other work.

1. Indicate required clearances, method of field assembly, components, and location and size of each field connection.
2. Include locations and elevations of entrances showing activation and safety devices.
3. Wiring Diagrams: For power, signal, and activation- and safety-device wiring.
4. Include plans, elevations, sections, details, and attachments to other work for guide rails.

C. Samples: For each exposed product and for each color and texture specified, manufacturer's standard in size.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each operator for fire-rated door assemblies, signed by product manufacturer. Certify that operator is listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for use on types and sizes of labeled fire doors required.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For automatic door operators, including activation and safety devices, to include in maintenance manuals.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project and who employs a certified inspector.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. Certified Inspector Qualifications: Certified by the AAADM.

C. Source Limitations: Obtain automatic door operators, including activation and safety devices, from single source from single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

E. Exit-Door Requirements: Comply with requirements of authorities having jurisdiction for doors with automatic door operators serving as a component of a required means of egress.

F. Preinstallation Conference: Conduct conference at Project site.

1.10 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of door frames by field measurements before fabrication of exposed covers for automatic door operators.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Faulty or sporadic operation of automatic door operator, including activation and safety devices.
    b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements provide Stanley Access Technologies; Division of The Stanley Works; Magic Force™.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with standards indicated below:

1. Sheet: ASTM B 209.
2. Extrusions: ASTM B 221.

B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness, in manufacturer's standard thickness.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.3 AUTOMATIC DOOR OPERATORS, GENERAL

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated; and complying with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.

1. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load indicated on Drawings.

B. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation including spring closing when power is off.

C. Hinges: See Section 087100 "Door Hardware" for type of hinge for each door that door operator shall accommodate.

D. Housing for Overhead Concealed Operators: Fabricated from minimum 0.125-inch- thick, extruded or formed aluminum and extending full width of door opening including door jambs to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.

E. Cover for Surface-Mounted Operators: Fabricated from 0.125-inch- thick extruded or formed aluminum ; continuous over full width of operator-controlled door opening; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.

F. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.

2.4 LOW-ENERGY DOOR OPERATORS

A. Standard: BHMA A156.19.

B. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.

C. Configuration: Operator to control single swinging door.

1. Traffic Pattern: Two way.
2. Operator Mounting: Surface.

D. Operation: Power opening and spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.

E. Operating System: Electromechanical.

F. Microprocessor Control Unit: Solid-state controls.

G. Features:

1. Adjustable opening and closing speed.
2. Adjustable opening and closing force.
3. Adjustable backcheck.
4. Adjustable hold-open time from zero to 30 seconds.
5. Adjustable time delay.
6. Adjustable acceleration.
7. Obstruction recycle.
8. On-off/hold-open switch to control electric power to operator; key operated.

H. Exposed Finish: Finish exposed components with finish matching door and frame.

2.5 ACTIVATION AND SAFETY DEVICES

A. General: Provide activation and safety devices in accordance with BHMA standards, for condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

B. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message. Provide 2 switches per door operator.

1. Configuration: Square push plate with 4-by-4-inch junction box.
   a. Mounting: Recess mounted, semiflush in wall unless otherwise indicated.
2. Push-Plate Material: Stainless steel as selected by Architect from manufacturer's full range.
3. Message: International symbol of accessibility and "Push to Open."

C. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.6 FABRICATION

A. Factory fabricate automatic door operators to comply with indicated standards.

B. Form aluminum shapes before finishing.

C. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.

D. Provide metal cladding, completely cladding visible surfaces before shipment to Project site. Fabricate cladding with concealed fasteners and connection devices, with accurately fitted joints

with ends coped or mitered to produce hairline joints free of burrs and distortion, and with allowance for thermal expansion at exterior doors.

2.7 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. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.

D. 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. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of automatic door operators.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic door operator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install complete automatic door operators according to manufacturer's written instructions, including activation and safety devices, control wiring, and remote power units if any; connection to the building's power supply; and signage.

1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.
3. Low-Energy Door Operator Installation Standard: BHMA A156.19.

B. Activation and Safety Devices: Install devices and wiring according to manufacturer's written instructions and cited BHMA standard for type of operator and direction of pedestrian travel.

Connect activation- and safety-device wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Access-Control System: Connect operators to access-control system as specified in Section 281300 "Access Control."

D. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

3.3 FIELD QUALITY CONTROL

A. Inspection: Engage Installer's certified inspector to test and inspect automatic door operators and prepare test and inspection reports.

1. Certified inspector shall test and inspect each automatic door operator to determine compliance of installed systems with applicable BHMA standards.
2. Inspection Report: Certified inspector shall submit report in writing to Architect and Contractor within 24 hours after inspection.

B. Work will be considered defective if it does not pass tests and inspections.

3.4 ADJUSTING

A. Adjust automatic door operators to function smoothly and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

1. Adjust operators on exterior doors for weathertight closure.

B. After completing installation of exposed, factory-finished automatic door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.

C. Readjust automatic door operators after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

D. Occupancy Adjustment: 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 Project during other-than-normal occupancy hours for this purpose.

3.5 DEMONSTRATION

A. Engage a certified inspector to train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators.

END OF SECTION 087113

SECTION 087114 – SLIDING AND FOLDING DOOR HARDWARE

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. Single and double track pocket sliding door hardware.
2. Single and double track pocket door frame kits.
3. Wall-Mount (Barn) door hardware.

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: Show layout, components, track mounting and support, anchorage details, and interface with adjacent construction.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square, representing actual product, color, and finish.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

B. Warranty: Special warranty specified in this Section.

C. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and adjustment of cable tension and periodic cleaning and maintenance of all components.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store in dry, protected, well-ventilated area and protect from damage.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer with minimum five years documented experience.

1.5 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.6 WARRANTY

A. Provide manufacturer's limited lifetime warranty covering defects in materials and workmanship and limited to repair or replacement of defective product.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Knape & Vogt Mfg. Co.

2.2 POCKET OR BI-PARTING DOOR HARDWARE

A. Hardware for Pocket or Bi-Part doors 75 lbs. capacity with Steel box track and 4-wheel carriers.

1. Model: PKT-75S. Conforms to ANSI/BHMA A156.14, Grade 1, D8691 and D8692 with bi-parting kit - Grade 1, D8721, D8722.

a. Door Thickness: 1-1/8 inches to 1-3/4 inches.
b. Load Rating: Up to 75 lbs. per panel.
c. Track: Steel box track.

B. Hardware for Pocket or Bi-Part doors 75 to 250 lbs. capacity with aluminum box track and 4-wheel carriers.

1. Model: PKT-75A. Conforms to ANSI/BHMA A156.14, Grade 1, D8691 and D8692 for single doors and D8721, D8722 for Bi-Part doors.

a. Door Thickness: 1-1/8 inches to 1-3/4 inches.
b. Load Rating: Up to 75 lbs. per panel.
c. Track: Aluminum box track.

2. Model: PKT-100A. Conforms to ANSI/BHMA A156.14, Grade 1,D8691 and D8692 for single doors and D8721, D8722 for Bi-Part doors.

a. Door Thickness: 1-1/8 inches to 1-3/4 inches.
b. Load Rating: Up to 100 lbs. per panel.
c. Track: Aluminum box track.

3. Model: PKT-125A. Conforms to ANSI/BHMA A156.14, Grade 1, D8681, D8691 and D8692 for single doors and D8711, D8721 and D8722 for Bi-Part doors.

a. Door Thickness: 1-1/8 inches to 1-3/4 inches.
b. Load Rating: Up to 125 lbs. per panel.
c. Track: Aluminum box track.

4. Model: PKT-150A. Conforms to ANSI/BHMA A156.14, Grade 1, D8681, D8691 and D8692 for single doors and D8711, D8721 and D8722 for Bi-Part doors.

a. Door Thickness: 1-1/8 inches to 1-3/4 inches.
b. Load Rating: Up to 150 lbs. per panel.
c. Track: Aluminum box track.

5. Model: PKT-250A. Conforms to ANSI/BHMA A156.14, Grade 1, D8681, D8691 and D8692 for single doors and D8711, D8721 and D8722 for Bi-Part doors and D8011, D8012 for Heavy Duty Doors.

a. Door Thickness: 1-1/8 inches to 1-3/4 inches.
b. Load Rating: Up to 250 lbs. per panel.
c. Track: Aluminum box track.

2.3 POCKET DOOR FRAME ASSEMBLY

A. Pocket Door Frame Assembly for 3 foot Opening with 2 x 4 Framing, 6 feet 8 inch Door Height with steel box track and 4-wheel carriers.

1. KV Model PKF-75S-3. Includes metal header brackets to support 2 x 4 framing, nailer board and 4 metal split studs with wood inserts. Conforms to ANSI/BHMA A156.14, Grade 2, D8672 for single doors and D8721 and D8722 for Bi-Part doors.

a. Door Thickness: 1-1/8 inches to 1-3/4 inches.
b. Door Height: 6 feet 8 inches.
c. Load Rating: Up to 75 lbs.
d. Track: Steel box track.

B. Pocket Door Frame Assembly Kit for 3 foot Opening, 2 x 4 Framing, Door Height 6 feet 8 inch to 8 feet with aluminum box track and 4-wheel carriers.

1. KV Model PKF-100A-3. Includes wood header to support 2x4 framing, nailer board and 4 metal split studs with wood inserts. Conforms to ANSI/BHMA A156.14, Grade 1, D8671 and D8672 for single doors and D8721 and D8722 for Bi-Part doors.

a. Door Thickness: 1-3/8 inches to 1-3/4 inches.
b. Door Height: 6 feet 8 inches.
c. Load Rating: Up to 100 lbs.
d. Track: Aluminum box track.

2. KV Model PKF-100A7-3. Includes wood header to support 2 x 4 framing, nailer board and 4 metal split studs with wood inserts. Conforms to ANSI/BHMA A156.14, Grade 1, D8671 and D8672 for single doors and D8721 and D8722 for Bi-Part doors.

    a. Door Thickness: 1-3/8 inches to 1-3/4 inches.
    b. Door Height: 7 feet.
    c. Load Rating: Up to 100 lbs.
    d. Track: Aluminum box track.

3. KV Model PKF-100A8-3. Includes wood header to support 2 x 4 framing, nailer board and 4 metal split studs with wood inserts. Conforms to ANSI/BHMA A156.14, Grade 1, D8671 and D8672 for single doors and D8721 and D8722 for Bi-Part doors.

    a. Door Thickness: 1-3/8 inches to 1-3/4 inches.
    b. Door Height: 8 feet.
    c. Load Rating: Up to 100 lbs.
    d. Track: Aluminum box track.

C. Pocket Door Frame Assembly Kit for 3 foot Opening, 2 x 4 Framing, Door Height 6 foot 8 inches to 8 feet, 150 lbs. capacity with aluminum box track and 4-wheel carriers.

1. KV model PKF-150A-3. Includes wood header to support 2 x 4 framing, nailer board and 4 metal split studs with wood inserts. Conforms to ANSI/BHMA A156.14, Grade 1, D8671 and D8672 for single doors and D8711, D8721 and D8722 for Bi-Part doors.

    a. Door Thickness: 1-3/8 inch to 1-3/4 inches.
    b. Door Height: 6 feet 8 inches.
    b. Load Rating: Up to 150 lbs.
    c. Track: Aluminum box track.

2. KV model PKF-150A7-3. Includes wood header to support 2x4 framing, nailer board and 4 metal split studs with wood inserts. Conforms to ANSI/BHMA A156.14, Grade 1, D8671 and D8672 for single doors and D8711, D8721 and D8722 for Bi-Part doors.

    a. Door Thickness: 1-3/8 inch to 1-3/4 inches.
    b. Door Height: 7 feet.
    b. Load Rating: Up to 150 lbs.
    c. Track: Aluminum box track.

3. KV model PKF-150A8-3. Includes wood header to support 2x4 framing, nailer board and 4 metal split studs with wood inserts. Conforms to ANSI/BHMA A156.14, Grade 1, D8671 and D8672 for single doors and D8711, D8721 and D8722 for Bi-Part doors.

    a. Door Thickness: 1-3/8 inch to 1-3/4 inches.
    b. Door Height: 8 feet.
    b. Load Rating: Up to 150 lbs.
    c. Track: Aluminum box track.

D. Pocket Door Frame Assembly Kit for 4 foot Opening, 2 x 4 Framing, Door Height of 8 feet, 250 lbs. capacity with aluminum box track and 4-wheel carriers.

1. KV Model PKF-250A-4. Includes wood header to support 2 x 4 framing, nailer board and 6 metal split studs with wood inserts. Conforms to ANSI/BHMA A156.14, Grade 1, D8671 and D8672 for single doors and D8711, D8721 and D8722 for Bi-Part doors and D8011 and D8012 for heavy duty doors.

    a. Door Thickness: 1-3/8 inch to 1-3/4 inches.

b. Door Height: 8 feet.
b. Load Rating: Up to 250 lbs.
c. Track: Aluminum box track.

E. Pocket Door Frame Assembly Kit for 3 foot Opening, 2 x 6 Framing, 6 foot 8 inch Door Height, 100 lbs. capacity with aluminum box track and 4-wheel carriers.

1. KV Model PKF-100A6W-3. Includes wood header to support 2 x 6 framing, nailer board and 4 metal split studs with wood inserts. Conforms to ANSI/BHMA A156.14, Grade 1, D8671 and D8672 for single doors and D8711, D8721 and D8722 for Bi-Part doors.

a. Door Thickness: 1-3/8 inch to 1-3/4 inches.
b. Door Height: 6 feet 8 inches.
b. Load Rating: Up to 100 lbs.
c. Track: Aluminum box track.

F. Pocket Door Frame Assembly Kit for 3 foot Opening, 2 x 6 Framing, 6 foot 8 inch Door Height, 150 lbs capacity with aluminum box track and 4-wheel carriers.

1. KV Model PKF-150A6W-3. Includes wood header to support 2 x 6 framing, nailer board and 4 metal split studs with wood inserts. Conforms to ANSI/BHMA A156.14, Grade 1, D8671 and D8672 for single doors and D8711, D8721 and D8722 for Bi-Part doors.

a. Door Thickness: 1-3/8 inch to 1-3/4 inches.
b. Door Height: 6 feet 8 inches.
b. Load Rating: Up to 150 lbs.
c. Track: Aluminum box track.

2.6 WALL MOUNT DOORS

A. Hardware for Wall-Mount Single or Bi-Part doors with aluminum wall-mount box track, fascia, end cap pair and hardware.

1. KV model WM-M250A. Conforms to ANSI/BHMA A156.14-2007 D8011, D8681, D8691, D8012, D8692.

a. Door Thickness: 1 inch to 1-3/4 inches.
b. Door Height: 6 feet 8 inches.
c. Load Rating: Up to 250 lbs.
d. Track: Aluminum box track.

B. Hardware for wall-mount single of bi-part doors with stainless steel round track, ball bearing carriers and hardware for Wood or Glass doors (where specified).

1. KV Model SS-TMSS-65- “Stick” designed top-mount carrier with 78 ¾” stainless steel round rail.

a. Door Material: Wood.
b. Door Thickness: Up to 1-1/2 inches.
c. Load Rating: 250lbs maximum load capacity.
d. Rail: Stainless Steel.
e. Carrier: Stainless Steel.

2. KV Model SS-TMSS-65- “Stick” designed top-mount carrier with 78 ¾” stainless steel round rail.

a. Door Material: Wood.
b. Door Thickness: Up to 1-1/2 inches.
c. Load Rating: 250lbs maximum load capacity.
d. Rail: Stainless Steel.
e. Carrier: Stainless Steel.

3. KV Model SS-TMSS-65- “Stick” designed top-mount carrier with 78 ¾” stainless steel round rail.

a. Door Material: Wood.
b. Door Thickness: Up to 1-1/2 inches.
c. Load Rating: 250lbs maximum load capacity.
d. Rail: Stainless Steel.
e. Carrier: Stainless Steel.

4. KV Model SS-TMSS-65- “Stick” designed top-mount carrier with 78 ¾” stainless steel round rail.

a. Door Material: Wood.
b. Door Thickness: Up to 1-1/2 inches.
c. Load Rating: 250lbs maximum load capacity.
d. Rail: Stainless Steel.
e. Carrier: Stainless Steel.

5. KV Model SS-TMSS-65- “Stick” designed top-mount carrier with 78 ¾” stainless steel round rail.

a. Door Material: Wood.
b. Door Thickness: Up to 1-1/2 inches.
c. Load Rating: 250lbs maximum load capacity.
d. Rail: Stainless Steel.
e. Carrier: Stainless Steel.

6. KV Model SS-TMSS-65- “Stick” designed top-mount carrier with 78 ¾” stainless steel round rail.

a. Door Material: Wood.
b. Door Thickness: Up to 1-1/2 inches.
c. Load Rating: 250lbs maximum load capacity.
d. Rail: Stainless Steel.
e. Carrier: Stainless Steel

C. Hardware for wall-mount single of bi-part doors with stainless steel flat rail, ball bearing carriers and hardware for Wood doors.

1. KV Model SS-FRST-65- “Strap Stick” designed face-mount carrier with 72 stainless steel Flat Rail.

a. Door Material: Wood.
b. Door thickness up to 1-1/2”.
c. Load Rating: 250lbs maximum load capacity.
d. Rail: Stainless Steel.
e. Carrier: Stainless Steel

D. Hardware for wall-mount single of bi-part doors with round aluminum track, decorative carriers and hardware for wood doors. Note: Round aluminum track is ordered separately from Hardware kits that include carriers and other accessories for one door solution.

1. KV Model decorative carriers with 72” Round Aluminum Track.

    a. Door Material: Wood.
    b. Door thickness up to 1-1/2”.
    c. Load Rating: 250lbs maximum load capacity.
    d. Track: Round Aluminum.

        1) Black Powder Coated Track:

            a) Model RTBK-04-A 4’ Black Track.
            b) Model RTBK-06-A 6’ Black Track.
            c) Model RTBK-08-A 8’ Black Track.

        2) Bronze Powder Coated Track:

            a) Model RTBZ-04-A 4’ Bronze Track.
            b) Model RTBZ-06-A 6’ Bronze Track.
            c) Model RTBZ-08-A 8’ Bronze Track.

        3) Satin Nickel Powder Coated Track:

            a) Model RTSN-04-A 4’ Satin Nickel Track.
            b) Model RTSN-06-A 6’ Satin Nickel Track.
            c) Model RTSN-08-A 8’ Satin Nickel Track.

    e. Decorative Carrier Hardware kits:

        1) Black Powder Coated Carrier Kits:

            a) Model RT-SPBK-06 “SANTIAGO” black short carrier.
            b) Model RT-FDBK-06 “BARCELONA” black short carrier.
            c) Model RT-HSBK-06 “RUSHMORE” black short carrier.
            d) Model RT-HKBK-06 “SALZBURG” black short carrier.
            e) Model RT-VSBK-06 “VENICE black short carrier.
            f) Model RT-TMBK-06 “MONTE CARLO” black short carrier.
            g) Model RT-TSBK-06 “ATLANTIS” black short carrier.
            h) Model RT-STBK-06 “MACAU” black short carrier.

        2) Bronze Powder Coated Carrier Kits:

            a) Model RT-SPBZ-06 “SANTIAGO” bronze short carrier.
            b) Model RT-FDBZ-06 “BARCELONA” bronze short carrier.
            c) Model RT-HSBZ-06 “RUSHMORE” bronze short carrier.
            d) Model RT-HKBZ-06 “SALZBURG” bronze short carrier.
            e) Model RT-VSBZ-06 “VENICE bronze short carrier.
            f) Model RT-TMBZ-06 “MONTE CARLO” bronze short carrier.
            g) Model RT-TSBZ-06 “ATLANTIS” bronze short carrier.
            h) Model RT-STBZ-06 “MACAU” bronze short carrier.

        3) Satin Nickel Powder Coated Carrier Kits:

            a) Model RT-HSSN-06 “RUSHMORE” Satin Nickel short carrier.
            b) Model RT-HKSN-06 “SALZBURG” Satin Nickel short carrier.
            c) Model RT-VSSN-06 “VENICE Satin Nickel short carrier.
            d) Model RT-TMSN-06 “MONTE CARLO” Satin Nickel short carrier.
            e) Model RT-TSSN-06 “ATLANTIS” Satin Nickel short carrier.
            f) Model RT-STSN-06 “MACAU” Satin Nickel short carrier.

E. Hardware for wall-mount single of bi-part doors with flat aluminum track, decorative carriers and hardware for wood doors. Note: Flat aluminum track is ordered separately from Hardware kits that include carriers and other accessories for one door solution.

1. KV Model decorative carriers with 72" Flat Aluminum Track.

a. Door Material: Wood.
b. Door thickness up to 1-1/2".
c. Load Rating: 250lbs maximum load capacity.
d. Flat Track: Aluminum.

1) Black Powder Track:

a) Model FR-BK-04-A 4' Black Flat Track.
b) Model FR-BK-06-A 6' Black Flat Track.
c) Model FR-BK-08-A 8' Black Flat Track.

e. Decorative Flat Rail Carrier Hardware Kits:

1) Black Powder Carrier Kits:

a) Model FR-HK-08 3" Hook black carrier.
b) Model FR-HK-05 5" Hook black carrier.
c) Model FR-ST-03 3" Strap black carrier.
d) Model FR-TM-03 3" Top Mount black carrier.

2.8 ACCESSORIES

A. Provide all components recommended by hardware manufacturer or required to achieve a complete installation.

B. Provide all fasteners required, of type recommended by hardware manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until support and floor substrates have been properly completed.

B. Verify that structural supports are level and of adequate strength to support the applied loads.

C. Verify opening dimensions prior to fabrication and assembly.

D. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. 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 written instructions.

B. Install hardware level, plumb, sure, true and straight.

C. Adjust hardware as necessary to ensure smooth, quiet, and effortless operation and safety.

D. Clean track and hardware surfaces before hanging sliding doors.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion. Replace damaged products that cannot be repaired to original condition.

END OF SECTION 087114

SECTION 088000 - GLAZING

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. Section includes:

1. Glass products.
2. Laminated glass.
3. Insulating glass.
4. Glazing sealants.
5. Glazing tapes.
6. Miscellaneous glazing materials.

1.3 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances and adequate sealant thicknesses with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 PERFORMANCE REQUIREMENTS

A. 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.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

C. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures" based on mean roof heights above grade indicated on Drawings.

1) Basic Wind Speed: As indicated on Drawings.
2) Importance Factor: As indicated on Drawings.
3) Exposure Category: As indicated on Drawings.

b. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.

1) For monolithic-glass lites heat treated to resist wind loads.
2) For insulating glass.
3) For laminated-glass lites.

c. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
d. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

D. Windborne-Debris-Impact Resistance: Exterior glazing shall comply with enhanced-protection testing requirements in ASTM E 1996 for applicable Wind Zone when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on Project.

1. Large-Missile Test: For glazing located within 30 feet of grade.

E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

F. 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 monolithic-glass lites, properties are based on units with lites of thickness indicated.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For laminated insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.

5. 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.
6. 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.
    a. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

G. Manufacturing Tolerances: Vision glass shall be manufactured with the following tolerances:

1. Glass shall be heat-treated by horizontal (roller hearth) process with inherent roller-wave distortion parallel to the bottom edge of the glass as installed when specified.
2. Flatness Tolerances:
    a. Roller-Wave or Ripple: The deviation from flatness at any peak shall not exceed 0.003 inches as measured per peak to valley for 1/4 inch (6mm) thick glass. Electronic confirmation read-out per lite is required as a submittal of this fabrication tolerance. Certification of individual lites shall be provided upon request.
    b. Bow and Warp: The bow and warp tolerances shall not exceed 1/32 inch per linear foot.
    c. Heat-treated glass shall be free of visible mosaic or pattern optical distortion (as opposed to slight waviness noticeable when viewpoint is moving), and from defects caused by roller pick.

1.7 ACTION 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 and of 12-inch-long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

C. Samples: For the following products, in the form of 12-inch- square Samples for glass.

1. Tinted glass.
2. Coated glass.
3. Laminated glass.
4. Insulating glass.
5. Spandrel glass.
6. Fire-resistive glass.

D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

E. Qualification Data: For installers.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers.

B. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass, insulating glass, glazing sealants and glazing gaskets.

D. Comply with Florida Building Code Product Approval Notice of Acceptance for Exterior Glazing:

1. Submit test reports signed and sealed by an independent Florida P.E. certifying glazing system compliance for “wind-born debris” protection provisions per ASTM E 1996 ASTM E 1886 and the Florida Building Code High Velocity Hurricane Zone (HVHZ).

E. Preconstruction Adhesion and Compatibility Test Report.

F. Warranties: Sample of special warranties.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Glass Testing: Agency Qualifications:

1. Glass Testing Agency Qualifications: A qualified testing agency accredited according to NFR CAP 1 Certification Agency Program.

C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

D. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install glazing in mockups specified in Section 084113 “Aluminum-Framed Entrances and Storefronts” and Section 085113 “Aluminum Windows” to match glazing systems required for Project, including glazing methods.

1.10 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.11 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.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.12 FIELD 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 deg F.

1.13 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-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: 10 years from date of Substantial Completion.

B. 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 from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-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: 10 Insert number years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

2.2 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.3 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other uncoated glass).

E. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.

F. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.

G. Silicone-Coated Spandrel Glass: ASTM C1048, Type I, Condition C, Quality-Q3.

H. Reflective- and Low-E-Coated Spandrel Glass: ASTM C1376, Kind CS.

2.4 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, ionomeric polymer interlayer or cast-in-place and cured-transparent-resin 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 on Drawings.
4. Interlayer: Per Florida Building Code Product Approval requirements.

B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with one of the following to comply with interlayer manufacturer's written instructions:

1. Polyvinyl butyral interlayer.
2. Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
3. Ionomeric polymer interlayer.
4. Cast-in-place and cured-transparent-resin interlayer.
5. Cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film.

2.5 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. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.

B. Film-Faced Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch nominal thickness; faced on one surface with a clear glazing film; complying with testing requirements in 16 CFR 1201 for Category II materials.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite NT.
b. Safti First; SuperLite C/SP.
c. Vetrotech Saint-Gobain; SGG Keralite FR-F.

C. Fire-Protection-Rated Tempered Glass: 1/4-inch-thick, fire-protection-rated tempered glass, complying with testing requirements in 16 CFR 1201 for Category II materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. InterEdge, Inc., a subsidiary of AFG Industries, Inc.; PyroEdge-20.
b. Safti First; SuperLite 20.
c. Vetrotech Saint-Gobain; SSG Pyroswiss.

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. 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.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide the following:

a. Dow Corning Corporation: 795.

2. Applications: Curtainwall framing.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.

2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 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, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type 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.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units 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 publications, 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 outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

2.11 MONOLITHIC GLASS TYPES

A. Uncoated Clear Float-Glass Units Type 6: Class I (clear) Kind FT (fully tempered) float glass.

1. Thickness: 6.0 mm.

2.12 LAMINATED MONOLITHIC GLASS TYPES

A. Glass Type LMGL-01: Laminated Monolithic Glass for Exterior Aluminum Doors.

1. 9/16 inch Thick Laminated Glass.

a. Outboard Lite: ¼ inch heat strengthened glass, clear.
b. Interlayer: 0.10 inch clear PVB Saflex (Eastman Chemical Co.) interlayer.
c. Inboard Lite: ¼ inch heat strengthened glass, clear.

2. Performance Characteristics: TBD.

B. Glass Type LMGL-02: Laminated Monolithic Glass for Exterior Glazed Hollow Metal Doors.

1. 9/16 inch Thick Laminated Glass.

a. Outboard Lite: ¼ inch heat strengthened glass, clear.
b. Interlayer: 0.090 inch clear SentryGlas Plus ionoplast interlayer.
c. Inboard Lite: ¼ inch heat strengthened glass, clear.

2. Performance Characteristics: TBD.

C. Glass Type LMGL-03: Laminated Monolithic Glass for Automatic Sliding Entrance Doors.

1. 9/16 inch Thick Laminated Glass.

a. Outboard Lite: ¼ inch heat strengthened glass, clear.
b. Interlayer: Saflex CP (Eastman Chemical Co.); Composite glass interlayer with PET Core.
c. Inboard Lite: ¼ inch heat strengthened glass, clear.

2. Performance Characteristics: TBD.

2.13 LAMINATED INSULATING-GLASS UNITS

A. Glass Type ILGL-02: Laminated Insulated Glazing Units for Aluminum Storefront System.

1. 1 5/16 inch Thick Laminated Glass Unit.

a. Outboard Lite: Vitro Architectural Glass Solarban 60 low-e coated, #2 surface, ¼ inch tempered glass, clear.
b. Interpane Space: ½ inch air space.
c. Inboard Lite: ¼ inch heat strengthened glass, clear; laminated with 0.060 inch clear Solutia Saflex HP PVB interlayer and ¼ inch heat strengthened glass, clear.

2. Performance Characteristics: TBD.

B. Glass Type ILGL-03: Laminated Insulated Glazing Units for Fixed Aluminum Window Units.

1. 1 1/16 inch Thick Laminated Glass Unit.

a. Outboard Lite: 3/16 inch tempered glass, clear.
b. Interpane Space: 7/16 inch air space.

c. Inboard Lite: 3/16 inch heat strengthened glass, clear; laminated with 0.090 inch clear DuPont SentryGlas interlayer and 3/16 inch heat strengthened glass, clear.

2. Performance Characteristics: TBD.

C. Glass Type ILGL-04: Laminated Insulated Glazing Units for Sliding Aluminum-Framed Glass Door System.

1. 1 1/8 inch Thick Laminated Glass Unit.

a. Outboard Lite: 3/16 inch tempered glass, clear.
b. Interpane Space: ½ inch air space.
c. Inboard Lite: 3/16 inch heat strengthened glass, clear; laminated with 0.090 inch clear DuPont SentryGlas interlayer and 3/16 inch heat strengthened glass, clear.

2. Performance Characteristics: TBD.

2.14 INSULATING-GLASS UNITS

A. Glass Type IGL-01: Insulated Glazing Units for Aluminum Storefront System.

1. Basis of Design Manufacturer and Product:

a. Manufacturer: Vitro Architectural Glass.
b. Product: Solarban 70XL (2) + Clear

2. 1 inch Thick Insulated Glass Unit.

a. Outboard Lite: 1/4 inch thick, Type 1 (transparent glass, flat), Class 1 (clear) annealed float glass with Low-e coating on the Number 2 surface.
b. Interpane Space: ½ inch air space.
c. Inboard Lite: 1/4 inch thick, Type 1 (transparent glass, flat), Class 1 (clear) annealed float glass.

1) Kind FT (fully tempered) Condition A (uncoated surfaces).

3. Performance Characteristics:

a. Visible Light Transmittance: 64%.
b. Winter Nighttime U-Value: 0.28.
c. Summer Daytime U-Value: 0.26.
d. Solar Heat Gain Coefficient: 0.27.

2.15 FIRE-PROTECTION-RATED GLAZING TYPES

A. Glass Type GL-01: 20-minute fire-rated glazing without hose-stream test; fire-protection-rated tempered glass.

1. Provide safety glazing labeling.
2. Location: In rated doors only.

B. Glass Type GL-02: 45-minute fire-rated glazing, film-faced ceramic glazing.

1. Provide safety glazing labeling.
2. Location: In rated doors only.

C. Glass Type GL-03: 90-minute fire-rated glazing, film-faced ceramic glazing.

1. Provide safety glazing labeling.

2. Location: In rated doors only.

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.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

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. 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.

C. 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.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. 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.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where 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.

H. 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.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. 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.

K. 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 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

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 substances 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 buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from 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 in writing by glass manufacturer.

END OF SECTION 088000

SECTION 089119 – FIXED LOUVERS

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. Section includes

1. Fixed, extruded-aluminum louvers.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades, i.e., the axis of the blades are horizontal.

C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product specified.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans; elevations; sections; details and attachments to other work. Show profiles of frames and blades, angles and spacing.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Provide and comply with Miami-Dade NOA or Florida Building Code Product Approval where required.

1.5 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. Sample Warranties: For manufacturer's special warranties.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where alike in one or more respects regarding type, design, or factory-applied color finish.

B. Welding Standards: As follows:

1. Comply with AWS D1.2/D1.2M, "Structural Welding Code – Aluminum".
2. Comply with AWS D1.3, "Structural Welding Code--Sheet Steel."

C. SMACNA Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication.

1.8 WARRANTY

A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fixed and operable louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.

B. Structural Performance: Provide exterior metal louvers capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.

1. Wind Loads: Determine loads based on pressures as indicated on the Structural Drawings.

C. 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 ALMA 500-L.

D. Miami-Dade Protocols: Louver design shall pass the following tests:

1. PA 201-94 Large Missile Impact.
2. PA 202-94 Uniform Pressure (for ±150 psf wind load).
3. PA 203-94 Cyclic Wind Pressure.

E. Comply with Miami-Dade NOA or Florida Building Code Product Approval where required.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Drainable Horizontal Louvers:

1. Basis-of-Design Manufacturer and Product: Nailor Industries Inc. Model 1604DHPF.
2. Frame/Louver Depth: 4 inches.
3. Frame/Louver Material: Type 6063-T6 extruded aluminum.
4. Blades: Type 6063-T6 extruded aluminum, with reinforcing bosses.
5. Frame and Blade Nominal Thickness: 0.100 inch nominal wall thickness.
6. Blade Angle: Fixed at 37.5 degrees.
7. Blade Spacing: 4 inches on center.
8. Blade Support: Concealed type, factory installed on rear of louver.
9. Performance Requirements:
    a. Free Area: Not less than 9.65 sq. ft. for 48-inch wide by 48-inch high louver.
    b. Point of Beginning Water Penetration: Not less than 1164 fpm.
    c. Air Performance: Not more than 0.15 inch intake static pressure drop at the point of beginning water penetration.
10. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
11. Miami Dade NOA/Florida Building Code Product Approval: Mark units with approval number.

2.4 LOUVER SCREENS

A. General: Provide each exterior louver with louver screens complying with the following requirements:

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening, unless otherwise indicated.
3. Screen: 5/8” x 0.050 expanded, flattened aluminum bird screen in removable frame.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes indicated and to comply with the following requirements:

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Non-rewirable, U-shaped frames for permanently securing screen mesh.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M),Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B209 (ASTM B209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.

D. Stainless-Steel Sheet: ASTM A240/A240M, Type 304, No. 4 finish, with grain running parallel to length of blades and frame members.

E. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.
3. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
4. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless-steel fasteners.
5. For fastening stainless steel, use 300 series stainless-steel fasteners.
6. For color-finished louvers, use fasteners with heads that match color of louvers.

F. Anchors and Inserts: Of type, size, and material required for loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as needed for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

G. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.6 FABRICATION, GENERAL

A. 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.

B. Join frame members to each other and to fixed louver blades with welds concealed from view welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

C. Include supports, anchorages, and accessories required for complete assembly.

D. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less. At horizontal joints between louver units, provide horizontal mullions, unless continuous vertical assemblies are indicated.

E. Provide sill extensions and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.

F. Join frame members to one another and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view; unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.8 GALVANIZED-STEEL SHEET FINISHES

A. Finish louvers after assembly.

B. Surface Preparation: Clean surfaces with nonpetroleum solvent, so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A780/A780M.

C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 2 mils.

1. 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.

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. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

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 and vents 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 089119

SECTION 089516 - WALL VENTS

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 vents.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of metal finish required.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For flood vents, from ICC-ES.

B. Sample Warranties: For manufacturer's special warranties.

1.5 WARRANTY

A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain vents from single source from single manufacturer.

2.2 WALL VENTS

A. Extruded-Aluminum Wall Vents:

1. Extruded-aluminum louvers and frames, not less than 0.125-inch nominal thickness, assembled by welding; with 18-by-14 mesh, aluminum insect screening on inside face; incorporating weep holes, continuous drip at sill, and integral waterstop on inside edge of sill; of load-bearing design and construction.
2. Dampers: Aluminum blades and frames mounted on inside of wall vents; operated from exterior with Allen wrench in socket-head cap screw. Fabricate operating mechanism from Type 304 stainless-steel components.
3. Finish: Mill.

B. Cast-Aluminum Wall Vents:

1. One-piece, cast-aluminum louvers and frames; with 18-by-14 mesh, aluminum insect screening on inside face; incorporating integral waterstop on inside edge of sill; of load-bearing design and construction.
2. Dampers: Aluminum blades and frames mounted on inside of wall vents; operated from exterior with Allen wrench in socket-head cap screw. Fabricate operating mechanism from Type 304 stainless-steel components.
3. Finish: Mill.

2.3 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.

D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666 or ASTM A 240/A 240M, austenitic stainless steel, Type 304.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: As selected by Architect from manufacturer's full range.

C. Conversion-Coated Finish: AA-C12C42, nonetched, cleaned with inhibited chemicals, and chemical conversion coated with acid chromate-fluoride-phosphate.

D. Factory-Primed Finish: AA-C12C42R1x with air-dried primer of not less than 2-mil dry film thickness.

E. 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.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

F. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

G. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent 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.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.5 STAINLESS-STEEL FINISHES

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.
3. Directional Satin Finish: No. 4.

C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

D. Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install according to manufacturer's written instructions.

B. Locate and place vents level, plumb, and at indicated alignment with adjacent work.

C. Attach vents securely in place using fasteners supplied or approved by manufacturer.

D. Protect unpainted surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

E. Build vents into masonry work as construction progresses; comply with requirements in Section 042000 "Unit Masonry."

F. Provide perimeter reveals of uniform width for sealants and joint fillers, where indicated.

G. Use concealed anchorages.

3.2 ADJUSTING AND CLEANING

A. Adjust flood vents for proper operation.

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 vents 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.

END OF SECTION 089516

SECTION 092116.23 - 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: Gypsum board shaft wall assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or with 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, moisture damaged, or mold damaged.

1. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, and 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 PERFORMANCE REQUIREMENTS

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.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated.

B. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.

1. Depth: As indicated.
2. Minimum Base-Metal Thickness: 0.033 inch.

C. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.

1. Minimum Base-Metal Thickness: Matching steel studs.

D. Firestop Tracks: Provide firestop track at head of shaft wall on each floor level.

E. Room-Side Finish: Gypsum board.

F. Shaft-Side Finish: Gypsum shaftliner board, moisture- and mold-resistant Type X.

2.3 PANEL PRODUCTS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Gypsum Shaftliner Board, Moisture- and Mold-Resistant Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with moisture- and mold-resistant core and surfaces.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; ProRoc Moisture and Mold Resistant Shaftliner.
b. Georgia-Pacific Gypsum LLC, Subsidiary of Georgia Pacific; Dens-Glass Shaftliner.
c. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner XP.
d. USG Corporation; Sheetrock Brand Mold Tough Gypsum Liner Panel.

2. Thickness: 1 inch.
3. Long Edges: Double bevel.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

C. Gypsum Board: As specified in Section 092900 "Gypsum Board."

2.4 NON-LOAD-BEARING STEEL FRAMING

A. Recycled Content of Steel: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Framing Members: Comply with ASTM C 645 requirements for metal unless otherwise indicated.

1. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 unless otherwise indicated.

C. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:

1. Depth: 2-1/2 inches.
2. Minimum Base-Metal Thickness: 0.030 inch.

D. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.

1. Minimum Base-Metal Thickness: 0.030 inch.

E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the 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

F. Elevator-Hoistway-Entrance Struts: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches, matching studs in depth, and not less than 0.033 inch thick.

G. Finish Panels: As indicated.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.

C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

D. Track 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. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing according to ASTM E 1190 conducted by a qualified testing agency.

   a. Maximum Penetration: 3/4 inch.

2. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.

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.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board 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 Section 078100 "Applied Fireproofing."

B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall 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 ASTM C 754 other than stud-spacing requirements.

B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.

C. 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, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.

1. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.
2. Reinforcing: Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.033-inch minimum thickness of base metal (uncoated), accurately positioned and secured behind at least one layer of face panel.

D. Penetrations: 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.

E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

G. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.

H. 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.

3.4 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, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116.23

SECTION 092216 – NON-STRUCTURAL STEEL FRAMING

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. Section includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits and grid systems.

B. Related Sections:

1. Section 054000 "Cold-Formed Metal Framing" for exterior non-load-bearing wall studs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For dimpled steel studs and runners from ICC-ES.

1.5 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ClarkDietrich Building Systems.
2. Marino\WARE.
3. Steel Network, Inc. (The).
4. Telling Industries.

2.2 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 according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Design framing systems in accordance with American Iron and Steel Institute Publication “S220 - North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members”, except as otherwise shown or specified.

D. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft.

E. Horizontal Deflection: For wall assemblies, limited to 1/360 of the walls utilizing ceramic tile with cement board substrate and for walls supporting cabinetry.

2.3 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: Manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.

2.4 FRAMING SYSTEMS

A. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.

1. Steel Studs and Runners:
    a. Minimum Base-Metal Thickness:
        1) 0.0179 inch unless otherwise noted
        2) 0.027 inch and as indicated for partitions scheduled to receive adhered stone tiling or as per height requirements indicated on the drawings.
    b. Depth: As indicated on Drawings.
2. Dimpled Steel Studs and Runners:
    a. Minimum Base-Metal Thickness:
        1) 0.0147 inch unless otherwise noted.
        2) 0.0190 inch for partitions scheduled to receive adhered stone tiling or as per height requirements indicated on the drawings.
    b. Depth: As indicated on Drawings.

B. Slip-Type Head Joints: Where indicated, provide the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.

C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.027 inch.

D. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0179 inch.
2. Depth: 7/8 inch.

F. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 3/4 inch.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.
3. 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.

G. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

H. Resilient Furring Channels: 1/2-inch deep, 22 gauge steel sheet members designed to reduce sound transmission.

1. Basis of Design Manufacturer and Product:

a. Manufacturer: ClarkDietrich Building Systems.
b. Product RC Deluxe (RCSD) Resilient Channel.

2. Configuration: Asymmetrical.

2.5 SUSPENSION SYSTEMS

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. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

D. Carrying Channels: 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.

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
2. Steel Studs: ASTM C 645.
    a. Minimum Base-Metal Thickness: 0.0179 inch.
    b. Depth: As indicated on Drawings.
3. Dimpled Steel Studs and Runners: ASTM C 645
    a. Minimum Base-Metal Thickness: 0.015 inch
    b. Depth: As indicated on Drawings.
4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    a. Minimum Base Metal Thickness: 0.0179 inch.

F. 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.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal 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, 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.

C. Extruded Aluminum Partition Closure: Provide the following:

1. Basis of Design Manufacturer and Product:
    a. Manufacturer: Gordon Interior Specialties Division.
    b. Product: Mullion Mate extruded aluminum partition closure.
2. Materials:
    a. Aluminum extrusions: 6063-T5 temper, tensile strength 31 KSI (ASTM B 221, ASTM B 221 M).

b. Accessories: Acoustical Batts for sound attenuation.
c. General: Provide metals free from surface blemishes where exposed to view in finished unit. Surfaces that exhibit pitting, seam marks, roller marks, stains, and discolorations, or other imperfections on finished units are not acceptable. All metal shall be of the highest-grade commercial type.

3. Finishes:

a. Finish as selected by the Architect from the manufacturer's full range.

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.

1. 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.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Install extruded aluminum partition closure system as per the manufacturer's written recommendations.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

1. Space studs as follows:

a. Single-Layer Application: 16 inches o.c., unless otherwise indicated.
b. Multilayer Application: 16 inches o.c., unless otherwise indicated.
c. Tile backing panels: 16 inches o.c., unless otherwise indicated.

C. 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.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
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 not less than 2 studs at ends of arcs, place studs 6 inches o.c.

D. 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.

E. 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 in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

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 required to support standard suspension system members, 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.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. 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.

G. 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 092216

SECTION 092400 - CEMENT PLASTERING

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 vertical plasterwork (stucco).
2. Exterior horizontal and nonvertical plasterwork (stucco).

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Samples for Initial Selection: For each type of factory-prepared finish coat and for each color and texture specified.

D. Samples for Verification: For each type of factory-prepared finish coat and for each color and texture specified, 12 by 12 inches, and prepared on rigid backing.

1.5 QUALITY ASSURANCE

A. 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 for each substrate and finish texture indicated for cement plastering, including accessories.
    a. Size: 100 sq. ft. in surface area.
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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, moisture, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.7 FIELD CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E119 by a qualified testing agency

2.2 GLASS FIBER REINFORCING LATH

A. Glass Fiber Lath: Open weave, three-dimensional, self-furred, nominal 1/4” thick glass fiber reinforcing lath designed for use with field mix exterior cement plaster conforming to ASTM C926 in “scratch and brown” applications.

1. Basis of Design Manufacturer and Product: Subject to compliance with requirements, provide the following:

a. Manufacturer: Master Builder (BASF).
b. Product: PermaLath 1000.

2. Weave: Leno.
3. Min. Tensile Strength:

a. Warp: 59 kg/cm.
b. Weft: 57.9 kg/cm.

2.3 ACCESSORIES

A. General: Comply with ASTM C 1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Alabama Metal Industries Company; a Gibraltar Industries company.
   b. CEMCO; California Expanded Metal Products Co.
   c. ClarkDietrich Building Systems.
   d. Marino\WARE.
   e. Phillips Manufacturing Co.

2. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating.
3. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized-zinc coating.
4. External- (Outside-) Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized-zinc coating.
5. Cornerbeads: Fabricated from zinc-coated (galvanized) steel.

   a. Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
   b. Smallnose cornerbead with perforated flanges; use on curved corners.
   c. Smallnose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
   d. Bullnose cornerbead, radius 3/4 inch minimum, with expanded flanges; use at locations indicated on Drawings.

6. Casing Beads: Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
7. Control Joints: Fabricated from zinc-coated (galvanized) steel; 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.
8. Expansion Joints: Fabricated from zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
9. Two-Piece Expansion Joints: Fabricated from zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch wide; with perforated flanges.

C. Plastic Accessories: Manufactured from high-impact PVC.

1. 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.

2. 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.

3. 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.
4. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged reveals; with perforated concealed flanges; size as indicated on the drawings.

D. Cleavage Membrane:

1. Membrane: #15 Specification Felt - ASTM D4869, Type II, D226, Type I.

2.4 MISCELLANEOUS MATERIALS

A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Bonding Compound: ASTM C 932.

C. Fasteners for Attaching Metal Lath to Substrates: ASTM C 1063.

D. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter unless otherwise indicated.

2.5 PLASTER MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I.

1. Color for Finish Coats: White.

B. Colorants for Job-Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color to match Architect's sample.

C. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

D. Sand Aggregate: ASTM C 897.

1. Color for Job-Mixed Finish Coats: White.

E. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. El Rey Stucco Solutions; a Parex USA, Inc. brand.
b. Florida Stucco.
c. LaHabra Stucco Solutions; Parex USA.
d. Omega Products International, Inc.
e. QUIKRETE.

2. Color: As selected by Architect from manufacturer's full range.

2.6 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.

1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. of cementitious materials.

B. 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 0 to 3/4 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
b. Brown Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

C. Base-Coat Mixes for Use over Unit Masonry and Concrete: Single base (scratch) coat for two-coat plasterwork on low-absorption plaster bases as follows:

1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 0 to 3/4 part lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.

D. Job-Mixed Finish-Coat Mixes:

1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.

E. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plasters, comply with manufacturer's written instructions.

2.7 ACCESSORIES

A. Exhaust Ventilation Termination Box: UV stabilized, high impact polypropylene and ABS designed to withstand high temperatures and harsh environments. Fully assembled units comprised of a seamless, monolithic box cavity with a removable front louver, positive pitch sidewalls and integrated removable recess gravity dampers.

1. Basis of Design Manufacturer and Product: Subject to compliance with requirements, provide products by the following:

a. Manufacturer: XVent Box Ventilation; Red Viking Group Inc.
b. Product: SEB-S Series.

2. Product Characteristics:

a. Size: As indicated on the drawings.
b. Mounting Flange: Fixed.
c. Maximum Pressure: +375/-450 psf.
d. Compressive Strength: Applied load +3344 lbs/ Test strength 73psi.
e. Total Open Louver Free Area: 46.085 sq.in.
f. Color: As selected by the Architect from the manufacturers’ full range.

B. Warranty: Provide manufacturer’s standard 10 year warranty against manufacturer’s defects.

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 the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare smooth, solid substrates for plaster according to ASTM C 926.

3.3 INSTALLING GLASS FIBER REINFORCING LATH

A. Glass Fiber Lath: Install according to ASTM C 1787 and the manufacturer's written instructions.

3.4 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Reinforcement for External (Outside) Corners:

1. Install lath-type, external-corner reinforcement at exterior locations.

C. Control Joints: Locate as approved by Architect for visual effect and as follows:

1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
    a. Vertical Surfaces: 144 sq. ft.
2. At distances between control joints of not greater than 18 feet o.c.
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.

3.5 PLASTER APPLICATION

A. General: Comply with ASTM C 926, Table 1.

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 Mix: For base (scratch) coat, for two-coat plasterwork and having 3/8-inch thickness on masonry, as follows:

1. Portland cement mix.

D. Walls; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork over drainage plane with 3/4-inch total thickness, as follows:

1. Portland cement mix.

E. Ceilings; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork and having 3/4-inch, as follows:

1. Portland cement mix.

F. Plaster Finish Coats: Apply to provide float finish to match Architect's sample.

G. Concealed Exterior Plasterwork: Where plaster application is used as a base for adhered finishes, omit finish coat.

3.6 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.7 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work after plastering is complete. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 092400

SECTION 092900 - GYPSUM BOARD

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. Section includes:

1. Interior gypsum board.
2. Ceramic tile backing panels.
3. Exterior gypsum board for ceilings and soffits.

B. Related Sections include the following:

1. Section 061600 "Sheathing" for gypsum sheathing.
2. Section 092216 "Non-Structural Steel Framing" for non-structural framing and suspension systems that support gypsum board.
3. Section 092216.23 "Gypsum Shaft-Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, 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 FIELD 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 paper-faced gypsum panels 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 PERFORMANCE REQUIREMENTS

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.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Georgia-Pacific Gypsum, LLC
2. National Gypsum Company
3. USG Corporation

B. Gypsum Board, Type X: ASTM C 1396/C 1396M

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

D. Impact-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.

1. Core: 5/8 inch, Type X.
2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
5. Hard-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements according to test in Annex A1.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 SPECIALTY GYPSUM BOARD

A. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Georgia-Pacific Building Products.
b. National Gypsum Company.

2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
3. Long Edges: Tapered.

2.5 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer’s standard edges.

1. Products: Subject to compliance with requirements, provide the following:

a. CertainTeed Corp; GlasRoc Tile Backer
b. Georgia-Pacific Gypsum, LLC; DensShield Tile Backer.
c. USG; Durock Glass-Mat Tile Backer Board.

2. Core: 5/8 inch, Type X.
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.

1. Products: Subject to compliance with requirements, provide the following:

a. National Gypsum Company; PermaBase Brand Cement Board.
b. USG; Durock Brand Cement Board.

2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

1. Basis of Design Manufacturer and Product:

a. USG; Sheetrock Brand Glass-Mat Panel Mold Tough.

2. Core: 1/2 inch, Type X.

2.7 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced galvanized steel sheet.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Wall Mounted Deflection Beads: ASTM D 3678-97, Class 2; for head of wall details with deflections of up to 7/16”.

1. Basis of Design Manufacturer: Trim-Tex Inc.

a. Product: Vinyl Wall Mounted Deflection Bead.

2. Fire Rating: Class A for flame and smoke developed when tested as per ASTM E 84.

2.8 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. 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.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

D. Joint Compound for Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.9 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. 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.

D. Sound Attenuation Blankets: 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.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical 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.

1. Basis of Design Manufacturer:

    a. Pecora Corporation; Product AC-20 FTR.

F. Thermal Insulation: As specified in Division 7 Section "Thermal Insulation."

G. Polyethylene Vapor Retarders: ASTM D 4397, 6-mil thick sheet, with maximum permeance rating of 0.1 perm.

H. Sheet Vapor Retarder: Polyimide film vapor retarder for use with unfaced, vapor permeable glass fiber and mineral wool insulation in wall and ceiling cavities. Material has a permeance of 1 perm or less when tested to ASTM E 86, dry cup method and increases to greater than 10 perms using the wet cup method.

1. Basis of Design Manufacturer and Product: Certainteed; Product Membrain.
2. Water Vapor Permeance:
    a. ASTM E 86, dry cup method: 1.0 perms.
    b. ASTM E 86, wet cup method: 10.0 perms.
3. Fire Hazard Classification: ASTM E 84:
    a. Maximum Flame Spread Index: 20.
    b. Maximum Smoke Developed Index: 55.

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, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.

3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. 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.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Vertical and ceiling surfaces, unless otherwise indicated.
2. Type C: Where required for specific fire-resistance-rated assembly indicated.
3. Moisture- and Mold-Resistant Type: Vertical surfaces of interior face of exterior walls, vertical and ceiling surfaces of baths and as indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer

joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 INSTALLATION OF EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.

1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

3.5 INSTALLATION OF TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panel: 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 penetrations.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLATION OF VAPOR RETARDERS ON FRAMING

A. Place vapor retarders on side of construction indicated on Drawings.

B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.

D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.7 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.8 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, rounded edges, 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 0: Temporary partitions and surfaces indicated to be finished in later stage of project.
2. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
3. Level 2: Panels that are substrate for tile.
4. Level 3: Where indicated on Drawings.
5. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
    a. Primer and its application to surfaces are specified in other Division 9 Sections.
6. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
    a. Primer and its application to surfaces are specified in other Division 9 Sections.

E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

3.9 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, moisture damaged, and 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.

END OF SECTION 092900

SECTION 093014 – EXTERIOR CERAMIC TILING

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. Section includes:

1. Exterior porcelain tile.
2. Waterproof membrane and crack-suppression membrane.
3. Exterior setting materials.
4. Tile backing panels.
5. Metal edge strips.

B. Related Sections:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 092900 "Gypsum Board" for glass-mat, water-resistant backer board.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 – 2012 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Nominal tile size as defined in ANSI A137.1.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION 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 required.
2. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
3. Full-size units of each type of trim and accessory for each color and finish required.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Test Reports: For each tile-setting and -grouting product.

1.7 MAINTENANCE MATERIAL SUBMITTALS

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 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 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. Waterproofing and crack isolation membrane.
2. Joint sealants.
3. Metal edge strips.

1.9 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. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.

E. 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.

1.10 FIELD 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer and Product: Subject to compliance with requirements, provide the following products:

1. Manufacturer: Daltile.
2. Product: Ambassador.
    a. Pattern: Random Linear Mosaic.
    b. Finish: Matte.
    c. Color: Jet-Setter Dusk AM34.

B. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
2. Obtain waterproof membrane, except for sheet products, from manufacturer of setting and grouting materials.

2.2 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.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. As indicated on Drawings.

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

1. Where tile is indicated for installation on exteriors, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 WATERPROOF AND CRACK ISOLATION MEMBRANE

A. General: Manufacturer’s standard product, selected from the following that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Laticrete International Inc.; Laticrete Hydro Ban or a comparable product of the following:

a. MAPEI Corporation.
b. Custom Building Products.

2.4 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Custom Building Products, Mega-Lite Rapid or Mega-Lite Regular (for hot installation conditions) or a comparable product by the following:

a. MAPEI Corporation.

b. Laticrete International, Inc.

B. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less., that complies with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.5 GROUT MATERIALS

A. Latex-Modified Tile Grout: ANSI A118.7.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Custom Building Products, Product Prism or comparable product by one of the following:

a. MAPEI Corporation.
b. Laticrete International, Inc.

2. Polymer Type: Calcium aluminate cement based, latex polymer-modified formula, in dry, redispersible form, prepackaged with other dry ingredients.

2.6 SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

A. Silicone, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Products: Subject to compliance with requirements, provide Dow Corning Corporation; Dowsil 790.
2. Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that demonstrate deterioration or failure under normal use within warranty period specified. Provide manufacturer’s standard material warranty of twenty (20) years beginning at the date of Substantial Completion

2.7 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.

2.8 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 coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil or silicone and comply with flatness tolerances required by ANSI A108.01 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. Fill cracks, holes, and depressions in substrates for tiles installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. 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.

3.3 TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:

    a. Exterior ceramic tile.

B. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. 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.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. 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.
2. Where adjoining tiles on walls or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on walls or trim, align joints unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Wall Tile: 1/16 inch.

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

3.4 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 epoxy and 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 and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.5 EXTERIOR WALL INSTALLATION SCHEDULE

A. Exterior Wall Installations, Masonry or Concrete:

1. TCNA W202: Thinset mortar over waterproof membrane.

a. Ceramic Tile Type: Exterior ceramic tile.
b. Mortar: Latex-Portland Cement Mortar.
c. Grout:

1) Standard unsanded cement.

END OF SECTION 093014

SECTION 099113 - EXTERIOR PAINTING

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. Section includes surface preparation and the field application of paint systems on the following exterior substrates:

1. Concrete.
2. Concrete masonry units (CMU).
3. Steel.
4. Galvanized metal.
5. Fiber-cement boards and panels.
6. Aluminum (not anodized or otherwise coated).
7. Wood.

B. Related Sections:

1. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
2. Section 099653 “Elastomeric Coatings” for application of paint systems on exterior stucco.

C. Scope: Finish all exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

1. Exposed surfaces of steel lintels and ledge angles.
2. Mechanical and Electrical: On the roof and outdoors, paint all equipment that is exposed to weather or to view.

D. Do Not Paint or Finish the Following Items:

1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Non-metallic roofing and flashing.
6. Stainless steel, anodized aluminum, bronze, terne, and lead items.
7. Marble, granite, slate, and other natural stones.
8. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
9. Glass.
10. Acoustical materials, unless specifically so indicated.

11. Concealed pipes, ducts, and conduits.

1.3 DEFINITIONS

A. Gloss Level 1 (G1) - Matte: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2 (G2) - Velvet: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3 (G3) - Eggshell: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4 (G4) - Satin: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5 (G5) – Semi-Gloss: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6 (G6) - Gloss: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7 (G7) – High Gloss: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including VOC content. Use of paint products containing greater than 6 one-hundredths of one percent (0.06%) lead by weight is prohibited.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

F. Qualification Data: For Applicator.

G. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

C. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

D. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. 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. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: PPG Paints.

B. Other Acceptable Manufacturers:

1. Benjamin Moore & Co.
2. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.

1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Supply each coating material in quantity required to complete entire project's work from a single production run.
3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:

1. Provide coatings that comply with the most stringent requirements specified in the following:

a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:

1) Opaque, Flat: 50 g/L, maximum.
2) Opaque, Nonflat: 150 g/L, maximum.
3) Opaque, High Gloss: 250 g/L, maximum.
4) Varnishes: 350 g/L, maximum.

c. Architectural coatings VOC limits of State in which the project is located.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Colors: As indicated on drawings.

1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.3 EXTERIOR PRIMERS

A. Exterior Concrete: Factory formulated acrylic masonry primer for exterior application.

1. PPG; 4-603XI Perma-Crete Interior/Exterior Alkali Resistant Primer. Applied at a dry film thickness of not less than 1.2 mils

B. Exterior CMU Masonry Block Fillers: Factory formulated acrylic block filler for exterior application.

1. PPG; 6-15XI SpeedHide Interior/Exterior Acrylic Masonry Block Filler: Applied at a dry film thickness of not less than 8.0 mils.

C. Exterior Ferrous Metals: Factory formulated acrylic primer.

1. Primer for Items Not Shop-Primed: PPG; 6-208 Speedhide Alkyd Metal Primer: Applied at a dry film thickness of not less than 2.3 mils.
2. Primer: PPG; 6-208 Speedhide Alkyd Metal Primer: Applied at a dry film thickness of not less than 2.3 mils.

D. Exterior Galvanized Metals: Factory formulated acrylic primer.

1. Primer for Items Not Shop-Primed: PPG; 90-712 Pitt Tech Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils.
2. Primer: PPG; 90-712 Pitt Tech Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils.

E. Exterior Water Resistant Soffit Board and Ceiling Board: Factory formulated primer for exterior application.

1. PPG; 4-603XI Perma-Crete Interior/Exterior Alkali Resistant Primer. Applied at a dry film thickness of not less than 1.2 mils.

F. Exterior Aluminum: Factory formulated primer for new exterior aluminum surface application.

1. Fluoropolymer System: PPG; Coraflon ADS Build Epoxy Primer/Intermediate ADS 573 / ADS 574. Applied at a dry film thickness of not less than 3.0 mils.
2. Acrylic-Enamel Finish: PPG; 90-712 Pitt-Tech Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils.

G. Exterior Fiber Cement Boards and Panels: Factory formulated primer for exterior application.

1. PPG; 4-603XI Perma-Crete Interior/Exterior Alkali Resistant Primer. Applied at a dry film thickness of not less than 1.2 mils.

H. Exterior Wood: Factory formulated primer for exterior application.

1. PPG; 17-921XI Seal Grip 100 Percent Acrylic Universal Primer. Applied at a dry film thickness of not less than 1.6 mils.

2.4 EXTERIOR FINISH COATS

A. Exterior Flat Acrylic Paint: Factory formulated flat acrylic emulsion latex paint for exterior application.

1. PPG; 6-610XI Series SpeedHide Exterior House Paint Flat Latex. Applied at a dry film thickness of not less than 1.5 mils.

B. Exterior Gloss Alkyd Enamel: Factory formulated alkyd enamel finish coats over primer for exterior applications.

1. PPG; 7-282 Series PPG Industrial Gloss-Oil Interior/Exterior Enamel. Applied at a dry film thickness of not less than 2.0 mil.

C. Exterior Semi-gloss Acrylic Enamel: Factory formulated semi-gloss acrylic latex enamel for exterior application.

1. PPG; 6-900XI Series SpeedHide Exterior House and Trim Semi-Gloss Acrylic Latex Paint. Applied at a dry film thickness of not less than 1.5 mils.

D. Exterior Aluminum: Factory formulated acrylic enamel for exterior aluminum surface application.

1. PPG; 4216HP Series Pitt-Tech Plus Interior/Exterior Semi-gloss DTM Industrial Enamel. Applied at a dry film thickness of not less than 2.0 mils.

E. Exterior Aluminum: Factory formulated fluoropolymer system for exterior aluminum surface application.

1. PPG; PPG Coraflon ADS Intermix Satin and Gloss Fluoropolymer. Apply per instructions on the technical data bulletin.

2.5 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Fiber-Cement Board: 12 percent.
4. Gypsum Board: 12 percent.
5. Exterior Wood: 15 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
2. Seal surfaces that might cause bleed through or staining of topcoat.
3. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

D. Concrete and Unit Masonry Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

G. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

H. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-PC 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

I. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

J. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

K. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of paint materials with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from

previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Masonry/Concrete, Opaque, Latex, 3 Coat:

1. One coat of block filler.
2. Semi-gloss: Two coats of latex enamel.
3. Flat: Two coats of latex enamel.

B. Ferrous Metals, Primed, Alkyd, 2 Coat:

1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
2. Gloss: Two coats of alkyd enamel.
3. Semi-gloss: Two coats of alkyd enamel.

C. Ferrous Metals, Primed, Latex, 2 Coat:

1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
2. Gloss: Two coats of latex enamel.
3. Semi-gloss: Two coats of latex enamel.

D. Ferrous Metals, Primed, Epoxy, 3 Coat:

1. Primer: One coat of polymide-epoxy two component primer recommended by top coat manufacturer.
2. First Finish Coat: One coat of polymide-epoxy two component primer.
3. Top Finish Coat: One coat of acrylic urethane enamel.

E. Galvanized Metals, Alkyd, 3 Coat:

1. One coat galvanize primer.
2. Gloss: Two coats of alkyd enamel.
3. Semi-gloss: Two coats of alkyd enamel.

F. Galvanized Metals, Latex, 3 Coat:

1. One coat galvanize primer.
2. Gloss: Two coats of latex enamel.

3. Semi-gloss: Two coats of latex enamel.

G. Aluminum, Unprimed, Alkyd, 3 Coat:

1. One coat primer.
2. Semi-gloss: Two coats of alkyd enamel.

H. Aluminum, Unprimed, Urethane, 3 Coat:

1. One coat primer.
2. Semi-gloss: Two coats of urethane enamel; Color as selected.

I. Exterior Gypsum Board, Opaque, Alkyd, 3 Coat:

1. One coat of alkyd primer sealer.
2. Flat: Two coats of alkyd enamel.

J. Exterior Gypsum Board, Opaque, Latex, 3 Coat:

1. One coat of latex primer sealer.
2. Flat: Two coats of latex.

END OF SECTION 099113

SECTION 099653 - ELASTOMERIC 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 surface preparation and application of elastomeric coatings to the following exterior substrates:

1. Concrete.
2. Masonry
3. Stucco.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of elastomeric coating indicated.

C. Samples for Verification: For each type of elastomeric coating indicated and, in each color, and gloss.

1. Submit Samples on same type of substrate as that to receive application, 8 inches square.
2. Step coats on Samples to show each separate coat, including primers and block fillers as applicable.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, including the following:

1. Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Manufacturer's recommended spreading rate for each separate coat, including primers and block fillers for each type of substrate as applicable.
3. Printout of current "MPI Approved Products List" for each product category specified in Part 2 that specifies coatings approved by MPI, with the proposed product highlighted.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are from same production run (batch mix) as materials applied and that are packaged for storage in unopened, factory-sealed containers and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent but not less than 1 gal. of each material, color, and texture applied.

1.5 QUALITY ASSURANCE

A. MPI Standards: Comply with MPI standards indicated and provide elastomeric coatings listed in the "MPI Approved Products List."

1. Preparation and Workmanship: Comply with requirements in the "MPI Architectural Painting Specification Manual" for products and coating systems indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 90 deg F unless otherwise permitted by manufacturer's written instructions.

B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before starting or continuing coating operation.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace elastomeric coatings that fail within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Water penetration through the coating.
   b. Deterioration of coating beyond normal weathering.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Material Compatibility:

1. Provide elastomeric finish coatings and crack fillers, primers, and block fillers as applicable for use within elastomeric finish coatings that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each material or coat, provide products and spreading rates recommended in writing by elastomeric coating manufacturer for use on substrate indicated.

2.2 ELASTOMERIC FINISH COATINGS

A. Exterior Flat Waterborne, Pigmented Elastomeric Coating:

1. BASF Building Systems; MasterProtect EL 750.
2. Surface Profile: Fine texture.
3. VOC Content: 100 g/L or less.
4. Moisture-Vapor Transmission: Minimum 10, based on testing according to ASTM D 1653.

2.3 OTHER MATERIALS

A. Crack Fillers: Elastomeric coating manufacturer recommended, factory-formulated crack fillers or sealants, including crack filler primers, compatible with substrate and other materials indicated; VOC content complying with limits of authorities having jurisdiction.

B. Primer: Elastomeric coating manufacturer's recommended, factory-formulated, alkali-resistant primer compatible with substrate and other materials indicated.

1. VOC Content: 200 g/L or less when thinned to manufacturer's maximum recommendation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with manufacturer's requirements for maximum moisture content, alkalinity, and other conditions affecting performance of work.

B. Begin coating only when moisture content of substrate is 12 percent or less when measured with an electronic moisture meter.

C. Begin coating no sooner than 28 days after substrate is constructed and is visually dry on both sides.

D. Verify that substrate is within the range of alkalinity recommended by manufacturer.

E. Verify suitability of substrates including surface conditions and compatibility with existing finishes and primers.

F. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in the "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.

1. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.
2. Perform cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.

D. Crack Repair: Fill cracks according to manufacturer's written instructions before coating surfaces.

3.3 APPLICATION

A. Apply elastomeric coatings according to manufacturer's written instructions.

1. Use equipment and techniques best suited for substrate and type of material being applied.
2. Coat surfaces behind movable items the same as similar exposed surfaces.
3. Apply each coat separately according to manufacturer's written instructions.

B. Primers: Apply at a rate to ensure complete coverage.

C. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats similar to color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.

D. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform finish, color, and appearance.

E. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

F. Apply coatings to prepared surfaces as soon as practicable after preparation and before subsequent surface soiling or deterioration.

G. Spray Application: Use spray equipment for application only when permitted by authorities having jurisdiction. Wherever spray application is used, do not double back with spray equipment to build up film thickness of two coats in one pass.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities, touch up and restore damaged or defaced coated surfaces.

3.5 COATING SCHEDULE

A. Concrete Substrates:

1. Elastomeric Coating System MPI EXT 3.1F:

a. Prime Coat: As recommended in writing by topcoat manufacturer.
b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
c. Topcoat: Elastomeric, pigmented, exterior, water-based, flat coating; MPI #113.

2. Finish-Coat Color: As selected by Architect from manufacturer's full range.

B. Concrete Unit Masonry Substrates:

1. Elastomeric Coating System MPI EXT 4.2D:

a. Prime Coat: As recommended in writing by topcoat manufacturer.
b. Block Filler: As recommended in writing by topcoat manufacturer.
c. Intermediate Coat: As recommended in writing by topcoat manufacturer.
d. Topcoat: Elastomeric, pigmented, exterior, water-based, flat coating; MPI #113.

2. Finish-Coat Color: As selected by Architect from manufacturer's full range.

C. Stucco Substrates:

1. Elastomeric Coating System MPI EXT 9.1C:

a. Primer: As recommended in writing by topcoat manufacturer.
b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
c. Topcoat: Elastomeric, pigmented, exterior, water-based, flat coating; MPI #113.

2. Finish-Coat Color: As selected by Architect from manufacturer's full range.

END OF SECTION 099653

SECTION 099726 - CEMENTITIOUS 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 surface preparation and application of cementitious coating systems on the following exterior substrates:

1. Concrete.
2. Concrete masonry units.
3. Brick.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: In each color and gloss of topcoat.

1. Submit Samples on rigid backing, not less than 8 inches' square, with mortar joint in center.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each cementitious coating, from manufacturer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency or performed by a qualified testing agency, for each product formulation.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are from same production run (batch mix) as materials applied and that are packaged with protective covering for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent of each color applied.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with minimum 15 years of experience in manufacturing of specified products and systems. Company shall be ISO 9001:2000 Certified.

B. Applicator Qualifications: Company with minimum of 5 years' experience in application of specified products and systems on projects of similar size and scope and is acceptable to product manufacturer.

1. Successful completion of a minimum of 5 projects of similar size and complexity to specified Work.

C. Mockups: Apply mockups of coating system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one actual substrate of each type to represent surfaces and conditions for application of coating.

a. Wall Surfaces: Prepare Samples of at least 100 sq. ft.

2. Apply mockups after permanent lighting and other environmental services have been activated.
3. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of colors selected by Architect at no added cost to Owner.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, new, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.
2. Manufacturer's stock number and date of manufacture.
3. Contents by volume, for pigment and vehicle constituents.
4. Application instructions.
5. Color name and number.
6. Handling instructions and precautions.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.

1. Protect cementitious coating materials from freezing. Keep materials dry and storage area neat and orderly. Remove waste daily. Take necessary measures to ensure that workers and work areas are protected from health hazards resulting from handling, mixing, and applying the coating.

1.8 FIELD CONDITIONS

A. Do not apply in rain or when rain is expected within 24 hours. Do not apply above 90 degrees F (32 degrees C) or below 40 degrees F (4 degrees C) or when temperatures are expected to fall below 40 degrees F (4 degrees C) within 24 hours. For hot and cold temperature applications,

store materials and water at 50 degrees F (10 degrees C) to 70 degrees F (21 degrees C) before use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: BASF Corporation; Master Builders Solutions

1. Products:

a. Standard Coating: MasterSeal 581.

B. Source Limitations: Obtain cementitious coating materials from single source and from single manufacturer.

2.2 CEMENTITIOUS COATINGS

A. Portland-cement based coating for concrete and masonry that resists both positive and negative hydrostatic pressure.

B. Performance Requirements: Provide patching material complying with the following requirements:

1. Service temperatures: Immersion, up to 140 degrees F (60 degrees C); cleaning water, up to 200 degrees F (93 degrees C); dry air, up to 220 degrees F (104 degrees C).
2. VOC: 0 lbs/gal (0 g/L) less water and exempt solvents.
3. Initial Set, minutes at 70-degree F (21-degree C), 50 percent relative humidity: 10 minutes per Lab Method.
4. Final Set, minutes at 70-degree F (21-degree C), 50 percent relative humidity: 90 minutes per Lab Method.
5. Density (cured): 129 pounds per foot (2,080 kg/m) per Lab Method.
6. Positive resistance to hydrostatic pressure, hrs, at 200 psi (1.4 MPa), 461 head feet, air cured at 70-degree F (21-degree C) 50 percent relative humidity: 752 (No leakage, no softening) per CRD C 48, modified:
7. Negative resistance to hydrostatic pressure, hours, at 200 psi (1.4 MPa), 461 head feet, air cured at 70-degree F (21-degree C) 50 percent relative humidity: 664 (Limited dampness) per CRD C 48, modified.
8. Potable water (direct contact): Suitable approved per BS6920 (British standard), NSF Standard 61.
9. Water absorption, boiling water submersion at 24 hour: 3.6 percent per ASTM C 67 (Section 7.3).
10. Compressive strength, ASTM C 109:

a. 7 days: 4,200 psi.
b. 28 days: 6,030 psi.

11. Flexural strength, ASTM C 348:

a. 7 days: 360 psi.
b. 28 days: 1,027 psi.

12. Tensile strength, ASTM C 190.

a. 7 days: 250 psi.

b. 28 days: 440 psi.

13. Modulus of elasticity, ASTM C 469, 28 days: 2.72 x 10 to the 6th psi.
14. Artificial weathering, hrs:

    a. Xenon Arc: 5,000 = No failure per ASTM G 26.
    b. Carbon Arc: 500 = No failure per ASTM G 23.

15. Adhesion strength, Test by tensile bond: 418 psi.
16. Artificial weathering, Atlas Type DMC weatherometer: No cracking, loss of adhesion, checking or other defect.
17. Freeze/thaw resistance, 200 cycles: No change per ASTM C 666 (Procedure B).
18. Salt spray resistance, 300 hours: No defect per ASTM B 117.
19. Carbon Dioxide (CO2), 1/16 inch (1.6 mm) per Lab Method Diffusion. Equivalent to 3/4 inch new concrete.
20. Permeance:

    a. Perms: 12 (0.10698) per ASTM E 96.
    b. Metric permeability 18 x 10 to the 3rd resistance (water-vapor transmission) per Swedish standard SS-02-15-82.

21. Wind-driven rain, hrs: 8 = excellent per Fed. Spec. TT-P-0035 (Para 4.4.7).
22. Coefficient of thermal expansion in/in/degree F (mm/mm/degree C), at 28 days: 6.99 x 10 to the minus 6th (5 x 10 to the minus 7th) per ASTM C 531.
23. Impact strength (Gardener impact tester): No chipping per Fed. Spec. TT-P-0035 (Cement paints para. 3.4.8).
24. Hardness, (Barber Colemen Impressor) Requirement min = 30, max = 60 (para 4.4.9) Fed. Spec. TT-P-0035:

    a. 7 days: 35.
    b. 14 days: 47.
    c. 21 days: 52.

25. Abrasion resistance 3,000 L sand: Passed per Fed. Spec. TT-P-141B.
26. Reflectance ASTM D 2244 using Hunterlab D-25 meter:

    a. Gray Thoroseal: 64.2.
    b. White Thoroseal: 88.1.

27. Fungus resistance at 21 days: No growth; meets all requirements of Fed. Spec. TT-P-29B.
28. Surface burning characteristics per ASTM E 84:

    a. Flame Spread: 0.
    b. Smoke developed: 5.

29. Fire Propagation Flame spread: Index = 1.5, Class 1 per BS476: Part 6:1981, BS476: Part 7:1971.

2.3 MIXING

A. Mix material per manufacturer instructions allowing material to rest 10 minutes before remixing and application.

B. Color:

1. White.
2. Standard Gray.
3. Custom Color as selected by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility.

C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Ensure that substrates are sound and free of dust, dirt, laitance, paints, oils, grease, curing compounds, and other contaminants.

B. Ensure substrate has properly cured. Concrete should obtain 80 percent of design strength. If efflorescence is present, mechanically remove it before proceeding.

C. Patch holes and cracks before installation.

D. Relieve hydrostatic pressure in concrete block with weep holes.

E. Roughen or brush blast extremely smooth surfaces to ensure good mechanical adhesion.

3.3 APPLICATION - GENERAL

A. Apply coating with manufacturer recommend brush or broom or equivalent stiff fiber brush or by textured spray equipment. Spray, back-brush, or broom applications of first coat to fill voids and achieve uniformity.

B. Completely dampen substrate with water before starting application. Do not saturate substrate. Keep substrate cool and damp throughout application.

C. Work first coat thoroughly into substrate to completely fill and cover voids, holes, and nonmoving cracks.

D. Allow to cure 24 hours, then apply second coat and finish with vertical stroke.

E. On concrete block or masonry walls, allow 5 to 7 days before applying second coat to eliminate joint read through.

F. Allow coating to cure 7 to 10 days before immersion in water.

3.4 ABOVE GRADE WITH POSITIVE SIDE WATER PRESSURE APPLICATION

A. Typical Application:

1. First Coat: 2 pounds per square yard = 225 square feet per 50-pound bag.
2. Second Coat: 1 pounds per square yard = 450 square feet per 50-pound bag.
3. Total: 3 pounds per square yard, cured nominal thickness of 1/16 inch.

B. Application at Struck Joints:

1. Spray and back-brush base coat of standard coating at 2 pounds per square yard and allow it to cure for 5 to 7 days.
2. Spray apply and back trowel topcoat of plaster mix at an application rate of 9 pounds per square yard.

3.5 BELOW GRADE EXTERIOR APPLICATION

A. Typical Application:

1. Total: 3 pounds per square yard, cured nominal thickness of 1/16 inch.

B. Application at High Hydrostatic Conditions: Refer to Drawings.

1. Spray and back-brush coat of standard coating at 4 pounds per square yard waterproofing from positive side if possible.

3.6 WALL/FLOOR COVE DETAILING

A. Cut out intersection of floor/wall and install waterstop cove seal at wall and floor junction prior to application of base coat.

3.7 CLEANING

A. Clean waterproofing material from tools and equipment with water. Remove cured materials mechanically.

B. Clean up and properly dispose of debris remaining on Project site related to application.

C. Remove temporary coverings and protection from adjacent Work areas.

3.8 PROTECTION

A. Protect system from damage during construction.

END OF SECTION 099726

SECTION 102113.14 - STAINLESS-STEEL 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. Section includes stainless-steel toilet compartments configured as toilet enclosures and urinal screens.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for blocking.
2. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 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 toilet compartments.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of reinforcements for compartment-mounted grab bars and locations of blocking for surface-mounted toilet accessories.
4. Show locations of centerlines of toilet fixtures.
5. Show locations of floor drains.

C. Samples for Initial Selection: For each type of toilet compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

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 Hinges: One hinge with associated fasteners.
2. Latch and Keeper: One latch and keeper with associated fasteners.
3. Door Bumper: One door bumper with associated fasteners.
4. Door Pull: One door pull with associated fasteners.
5. Fasteners: Ten fasteners of each size and type.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities for toilet compartments designated as accessible.

2.2 STAINLESS-STEEL TOILET COMPARTMENTS

A. Basis of Design Manufacturer and Products:

1. Manufacturer: Global Partitions Corp.
    a. Product: Stainless Steel. Refer to the Owner’s Interior Design Consultants Documents for additional information.

B. Toilet-Enclosure Style: Overhead braced, floor mounted.

C. Urinal-Screen Style: Wall hung flat panel.

D. Sight-Screen Style: Wall hung and floor anchored.

E. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures;

corners secured by welding or clips and exposed welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.

1. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch for doors and panels and 1-1/4 inches for pilasters.
2. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units of size and material adequate for panel to withstand applied downward load on grab bar of at least 250 lbf, when tested according to ASTM F 446, without deformation of panel.
3. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.

F. Urinal and Sight Screen Construction:

1. Flat-Panel Urinal Screen: Matching panel construction.

G. Facing Sheets and Closures: Stainless-steel sheet of nominal thicknesses as follows:

1. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.038 inch.
2. Panels: Manufacturer's standard thickness, but not less than 0.031 inch.
3. Doors: Manufacturer's standard thickness, but not less than 0.031 inch.
4. Flat-Panel Urinal Screens: Thickness matching the panels.

H. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

I. Urinal-Screen Post: Manufacturer's standard post design of material matching the thickness and construction of pilasters square, aluminum tube with satin finish with shoe and sleeve (cap) matching that on the pilaster.

J. Sight-Screen Post: Manufacturer's standard post design of material matching the thickness and construction of pilasters; with shoe and sleeve (cap) matching that on the pilaster.

K. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets; stainless steel.

L. Stainless-Steel Finish: Manufacturer's standard leather textured finish on exposed faces. Protect exposed surfaces from damage by application of strippable, temporary protective covering before shipment.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Stainless steel.
2. Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.
3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide

units that comply with regulatory requirements for accessibility at compartments designated as accessible.

4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel anchors compatible with related materials.

2.4 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).

C. Brass Castings: ASTM B 584.

D. Brass Extrusions: ASTM B 455.

E. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

F. Stainless-Steel Castings: ASTM A 743/A 743M.

G. Zamac: ASTM B 86, commercial zinc-alloy die castings.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories and solid blocking within panel where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.

D. Door Size and Swings: 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 designated as accessible.

E. Sight-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.
b. Panels and Walls: 1 inch.

2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached near top and bottom of panel.

a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

D. Sight-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.14

SECTION 102213 - WIRE MESH PARTITIONS

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. Section includes:

1. Standard-duty wire mesh partitions.

1.3 DEFINITIONS

A. As defined in ASTM E 2016:

1. Intermediate Crimp: Wires pass over one and under the next adjacent wire in both directions, with wires crimped before weaving and with extra crimps between the intersections.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wire mesh items.

B. Shop Drawings: Include plans, elevations, and large-scale details showing anchorage and accessory items.

1. Include clearances required for operation of doors.

C. Samples for Verification: 12-by-12-inch wire mesh panel constructed of specified frame members and wire mesh. Show method of finishing members at intersection.

1.5 INFORMATIONAL SUBMITTALS

A. Welding Certificates.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wire mesh unit hardware to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain wire mesh items from single source from single manufacturer.

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 "Structural Welding Code – Sheet Steel".

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with wire mesh units by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acorn Wire & Iron Works, Inc.; Product 130A Standard Duty Wire Mesh Partitions.
2. King Wire Partitions, Inc.; Product K-400 Standard Duty Wire Mesh Partitions.
3. Miller Wire Works, Inc.; Product 100M Standard All Wire Partition.

2.2 MATERIALS

A. Steel Wire: ASTM A 510

B. Steel Plates, Channels, Angles, and Bars: ASTM A 36 / A 36M

C. Square Steel Tubing: ASTM A 500, cold-formed structural-steel tubing.

D. Panel-to-Panel Fasteners: Manufacturer's standard steel bolts, nuts, and washers.

E. Postinstalled Expansion Anchors: With capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Carbon Steel: Zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition (mild).
2. Stainless Steel: ASTM F 593 and ASTM F 594, Alloy Group 1 or 2, for bolts and nuts; ASTM A 276 or ASTM A 666, Type 304 or 316, for anchors.
3. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
4. For Postinstalled Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated and 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 wire mesh construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

G. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer, complying with MPI#79.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

2.3 STANDARD-DUTY WIRE MESH PARTITIONS

A. Mesh: 10 gauge, 0.135-inch- diameter, intermediate-crimp steel wire woven into 1-1/2-inch diamond mesh.

B. Vertical Panel Framing: 1-1/4-by-5/8-by-0.097-inch cold-rolled, C-shaped steel channels with 1/4-inch- diameter bolt holes spaced not more than 18 inches o.c. along center of framing.

C. Horizontal and Vertical Panel Framing: 1-by-1/2-by-1/8-inch cold-rolled steel channels.

D. Horizontal Panel Stiffeners: 2 cold-rolled steel channels, not less than 1 by 3/8 by 1/8 inch, bolted or riveted toe to toe through mesh or 1-by-1/2-by-1/8-inch cold-rolled steel channels with wire woven through.

E. Corner Posts: 1-1/4-by-1-1/4-by-1/8-inch steel angles with floor shoe and 1/4-inch- diameter bolt holes to align with bolt holes in vertical frame members.

F. Intersection Posts: Where 3 or 4-way intersections occur, use 1-1/4-by-1-1/4-inch tubular steel posts with floor shoe and 1/4-inch- diameter bolt holes aligned for bolting to adjacent panels.

G. Floor Shoes: Cast metal, sized to suit vertical framing and to provide approximately 3 inches of clear space between finished floor and bottom horizontal frame members. Furnish units with set screws for leveling adjustment.

H. Swinging Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/4-by-1/2-by-1/8-inch steel channels with 1-1/4-by-1/8-inch flat steel bar cover plates on 3 sides, and 1/8-inch-thick angle strike bar and cover on lock side.

1. Hinges: 1-1/2 pairs of 3-by-3-inch butt hinges riveted or welded to door and frame.
2. Padlock Lug: Mortised into door framing and enclosed with steel cover.

I. Finish for Uncoated Ferrous Steel: Baked-enamel finish unless otherwise indicated.

1. Color: As selected by Architect from manufacturer's full range.

2.4 FABRICATION

A. General: Fabricate wire mesh items from components of sizes not less than those indicated. Use larger-sized components as recommended by wire mesh item manufacturer. As required for complete installation, provide bolts, hardware, and accessories with manufacturer's standard finishes.

1. Fabricate wire mesh items to be readily disassembled.

2. Welding: Weld corner joints of framing and finish sand.

B. Standard-Duty Wire Mesh Partitions: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.

1. Mesh: Securely clinch mesh to framing.
2. Framing: Fabricate framing with mortise and tendon corner construction.
    a. Provide horizontal stiffeners as indicated or, if not indicated, as required by panel height and as recommended by wire mesh partition manufacturer. Weld horizontal stiffeners to vertical framing.
    b. Fabricate three- and four-way intersections using intersection posts.
    c. Fabricate partition and door framing with slotted holes for connecting adjacent panels.
3. Fabricate wire mesh partitions with 3 inches of clear space between finished floor and bottom horizontal framing.
4. Fabricate wire mesh partitions with bottom horizontal framing flush with finished floor.
5. Doors: Align bottom of door with bottom of adjacent panels.
    a. For doors that do not extend full height of partition, provide transom over door, fabricated from same mesh and framing as partition panels.
6. Hardware Preparation: Mortise, reinforce, drill and tap doors and framing as required to install hardware.

2.5 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.

2.6 STEEL AND IRON FINISHES

A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

B. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and 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.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-on finish, suitable for use indicated, consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

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 the Work.

B. Examine floors for suitable conditions where wire mesh items will be installed.

C. Examine walls to which wire mesh items will be attached for properly located blocking, grounds, and other solid backing for attachment of support fasteners.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRE MESH PARTITIONS ERECTION

A. Anchor wire mesh partitions to floor as follows:

1. Cast-in-Place Concrete Floors: Anchor with 3/8-inch- diameter, postinstalled expansion anchors at toggle bolts through floor shoes located at each post and corner. Adjust wire mesh partition posts in floor shoes.

B. Anchor wire mesh partitions to walls at 12 inches o.c. through back corner panel framing and 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 wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.

C. Secure top capping bars to top framing channels with 1/4-inch- diameter "U" bolts spaced not more than 28 inches o.c.

D. Provide line posts at locations indicated or, if not indicated, as follows:

1. For partitions that are 7 to 9 feet high, spaced at 15 to 20 feet o.c.

E. Where standard-width wire mesh partition panels do not fill entire length of run, provide adjustable filler panels to fill openings.

F. Install doors complete with door hardware.

G. Weld or bolt sheet metal bases to wire mesh partitions and where indicated.

H. Bolt accessories to wire mesh partition framing.

3.3 ADJUSTING AND CLEANING

A. Adjust moving components for smooth operation without binding.

B. Touch up damaged finish after completing installation using field-applied paint to match color of shop-applied finish.

END OF SECTION 102213

SECTION 102600 – WALL AND DOOR PROTECTION

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. Section includes:

1. Corner guards.

1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each item showing locations and extent. Include sections, details and attachment to other work.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Corner Guards: 12 inches long. Include examples of joinery, corners and caps.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Test Reports: For each impact-resistant plastic material.

C. Material Certificates: For each impact-resistant plastic material, signed by manufacturer.

D. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each impact-resistant wall-protection unit to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain impact-resistant wall-protection units through one source from a single manufacturer.

B. Surface-Burning Characteristics: Provide impact-resistant, plastic wall-protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store wall-protection units 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 sheet material 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.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall-protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which 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.
    b. Deterioration of plastic 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- and door-protection products of each type] from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 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.

2.3 Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.4 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. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 for Alloy 6063-T5.

D. Stainless-Steel Sheet: ASTM A 240/A 240M.

E. 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.

F. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 CORNER GUARDS

A. Surface-Mounted, Opaque-Plastic Corner Guards: Fabricated as one piece from PVC-free plastic or acrylic-modified vinyl sheet; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.

1. Basis of Design Manufacturer and Product: As indicated on the Finish Schedule.
2. Wing Size:
    a. 3/4 by 3/4 inch
    b. 1-1/2 by 1-1/2.
    c. 2-1/2 by 2-1/2 inches.
3. Mounting: Adhesive.
4. Color and Texture: As selected by Architect from manufacturer's full range.

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. Basis of Design Manufacturer and Product: Subject to compliance with requirements, provide product as indicated on the Finish Schedule.
2. Material: Stainless-steel sheet, Type 304.
    a. Thickness: Minimum 0.0500 inch.
    b. Finish: As indicated on the Finish Schedule.
    c. Height: As indicated on Drawings.
3. Wing Size: Nominal 3-1/2 by 3-1/2 inches.
4. Corner Radius: 1/8 inch.
5. Mounting: Manufacturer standard retaining clips.

2.6 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Fabricate components with tight seams and joints 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.

C. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

D. 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.

2.7 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Remove tool and die marks and stretch lines, or blend into finish.
2. Grind and polish surfaces to produce uniform finish, free of cross scratches.
3. Run grain of directional finishes with long dimension of each piece.

B. Protect 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.

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 work.

1. 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.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall-protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install wall-protection units 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.

1. Install wall system components in accordance with manufacturer's written instructions.
2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
    a. Provide anchoring devices to withstand imposed loads.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 103100 - MANUFACTURED FIREPLACES

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. Section includes:

1. Manufactured fireplace units.

B. Related Sections include the following:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking for mounting items requiring anchorage.

1.3 ACTION SUBMITTALS:

A. Shop Drawings: Submit for complete installation, indicating required coordination of various trades involved.

B. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fireplace, from manufacturer.

B. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each fireplace to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with provisions of the following product certifications:

1. UL and NEMA: Provide electrical components required as part of fireplaces that are listed and labeled by UL and that comply with applicable NEMA standards.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fireplace units 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.

B. Field Measurements: Where electric fireplace units 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.

PART 2 - PRODUCTS

2.1 GAS FIREPLACES

A. Gas Fireplace (IL)

1. Basis-of-Design Product: Subject to compliance with requirements provide Heat & Glo Foundation See-Through Gas Fireplace Model #PRIMO 72ST.
2. Product Characteristics:
    a. Glass Size: Manufacturer's standard.
    b. Framing Dimensions: Manufacturer's standard.
    c. Dimension Gas Type: Natural gas.
    d. Gas Connection: 1/2" pipe.
    e. On/Off: Programmable / thermostatic remote control standard.
    f. Venting Options: Through exterior wall or vertical through roof; must vent 1' vertically before horizontal venting.

B. Gas Fireplace (AL)

1. Basis-of-Design Product: Subject to compliance with requirements provide Heat & Glo Stellar Model 5SS-24GLL.
2. Product Characteristics:
    a. Viewing Area: Manufacturer's standard.
    b. Framing Dimensions: Manufacturer's standard.
    c. Dimension Gas Type: Natural gas.
    d. Gas Connection: 1/2" pipe.
    e. On/Off: Programmable / thermostatic remote control standard.
    f. Venting Options: Through exterior wall or vertical through roof; Must vent 1' vertically before horizontal venting.

2.2 ELECTRIC FIREPLACES

A. Electric Fireplace (Memory Care):

1. Basis-of-Design Product: Subject to compliance with requirements provide Dimplex Revillusion 42" Built-In Electric Firebox, Model #RBFGLASS42WC.
    a. Height: 31.03 inches.
    b. Product Depth: 30.66 inches.
    c. Product Width: 109.8 inches.
    d. Product Height: 78.82 inches.

e. Product Weight: 40.18 lbs.
f. Product Width: 43.23 inches.
g. Wattage: 1375 W.
h. Voltage: 120v.
i. BTU: 4435.
j. Timer: Manufacturer’s standard.
k. Remote Control: Manufacturer’s standard.
l. Built-in Thermostat: Manufacturer’s standard.
m. Automatic Shut-off: Manufacturer’s standard.
n. Power Source: Electric.
o. Warranty: 2 years parts; 1 year service, limited.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

3.2 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 fireplace 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.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 103100

SECTION 104413 - FIRE EXTINGUISHER CABINETS

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. Section includes fire protection cabinets consisting of the following:

1. Interior Surface Mount.
2. Interior Recessed Non-Fire Rated Mount.
3. Interior Fire Rated Mount.
4. Exterior Surface Mount.

B. Related Sections:

1. Section 104416 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
2. Show location of knockouts for hose valves.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Size: 6 by 6 inches square.

D. 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.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

1.6 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.

PART 2 - PRODUCTS

2.1 FIRE PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Products: Subject to compliance with requirements, provide one of the following:

a. J. L. Industries, Inc., a division of Activar Construction Products Group; Ambassador Series.
b. Larsen's Manufacturing Company; Architectural Series.
c. Potter Roemer LLC; 7000 Series.

B. Cabinet Construction:

1. Nonrated, where indicated on the drawings.
2. Rated, where indicated on the drawings.

a. 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: Steel sheet.

D. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.

E. Semi-recessed 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. Rolled-Edge Trim: 2-1/2-inch backbend depth.

F. Recessed Cabinet:

1. Exposed Flat Trim: One piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbind).

G. Cabinet Trim Material: Steel sheet.

H. Exterior Surface Mounted Cabinet: UV resistant, injection-molded ABS plastic for a dent-, rust- and corrosion-proof protection. Includes brass lock, cover and labels.

I. Door Material: Steel sheet.

J. Door Style: Vertical duo panel with frame.

K. Door Glazing: Tempered float glass (clear).

L. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide recessed door pull and friction latch.
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

M. Accessories:

1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
    a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
        1) Location: Applied to location indicated on Drawings.
        2) Application Process: Pressure-sensitive vinyl letters.
        3) Lettering Color: Black.
        4) Orientation: Vertical.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 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.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 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 of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. 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.

B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.
2. Fire-Rated, Cabinets:
    a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
    b. Seal through penetrations with firestopping sealant as specified in Division 7 Section "Through-Penetration Firestop Systems."

C. Identification: Apply vinyl lettering at locations indicated.

D. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

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. Verify that integral locking devices operate properly.

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 104413

SECTION 104416 - FIRE EXTINGUISHERS

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. Section includes hand carried, fire extinguishers.

B. Related Sections:

1. Section 104413 "Fire Extinguisher Cabinets."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. 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.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.7 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.
    b. Faulty operation of valves or release levers.
2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 QUALITY ASSURANCE

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.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    b. Larsen's Manufacturing Company.
    c. Potter Roemer LLC.
2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. 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 Steel Container: UL-rated 4-A:80-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

C. Wet-Chemical Type: UL-rated 2-A:1-B:C:K, 2.5-gal. nominal capacity, with potassium acetate-based chemical in stainless-steel container; with pressure-indicating gage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 105500.13 – USPS-DELIVERY POSTAL SPECIALTIES

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. Section includes:

1. Mail receptacles.
2. Collection boxes.
3. Accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of postal specialty.

B. Shop Drawings: For each type of postal specialty. Include plans, elevations, sections, details, and attachments to other work.

1. Include identification sequence for compartments.
2. Include layout of identification text.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, prepared on 6-by-6-inch square Samples.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of postal specialty required to comply with USPS regulations, signed by product manufacturer. Include written approval by Postmaster General.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For postal specialties and finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

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. Key Blanks: Furnish not less than 50 for every 200 locks or fraction thereof, of each type of compartment door lock installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of postal specialty manufacturer for installation of units required for this Project.

B. Preinstallation Conference: Conduct conference at Project.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver lock keys to Owner by registered mail or overnight package service with a record of each corresponding lock and key number.

1.9 COORDINATION

A. Coordinate layout and installation of recessed postal specialties with wall construction.

B. Templates: Obtain and distribute to parties involved templates for installing postal specialties.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of postal specialties that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of hardware, except door locks.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MAIL RECEPTACLES

A. Front-Loading Mail Receptacles: Consisting of multiple compartments with fixed, solid compartment backs, enclosed within a recessed wall box. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging side-hinged

master door to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-STD-4C.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Florence Corporation; a Gibraltar Industries company.; Model 4CADD-10.

2. Front-Loading Master Door: Fabricated from extruded aluminum and braced and framed to hold compartment doors; prepared to receive master-door lock.
   a. Master-Door Lock: Door prepared to receive lock provided by local postmaster.
3. Compartments: As indicated on Drawings.
   a. Type III: A group of mail receptacles in double-column configuration with single master door, 16 mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep, one outgoing mail collection compartment prepared for master-door lock, and two parcel-locker compartment(s): 15 inches high by 12 inches wide by 15 inches deep.
4. Compartment Doors: Fabricated from extruded aluminum. Equip each with lock and tenant identification as required by USPS-STD-4C. Provide mail slot in the compartment with master-door lock.
   a. Compartment-Door Locks: Comply with USPS-L-1172C for locks and keys, or equivalent as approved by the USPS; with three keys for each compartment door. Key each compartment differently.
   b. Parcel-Locker-Compartment-Door Locks: Two-key security system in which control key provides access to parcel-locker-compartment key, which opens compartment and is retained once opened.
5. Frames: Fabricated from extruded aluminum or aluminum sheet; ganged and nested units, with cardholder and blank cards for tenant's identification within each compartment.
6. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
7. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
   a. Powder-Coated Finish: Color as selected by Architect from manufacturer’s full range.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, and as follows:

1. Sheet and Plate: ASTM B 209.
2. Extruded Shapes: ASTM B 221.

B. Steel Sheet: Cold rolled, ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

C. Metallic-Coated Steel Sheet: Galvanized steel sheet, ASTM A 653/A 653M, G60 coating designation; or electrolytic zinc-coated steel sheet, ASTM A 591/A 591M, Class C coating.

D. Steel Anchor Bolts, Nuts, and Washers: ASTM F 1554, Grade 36 or 55, hot-dip galvanized.

E. Stainless-Steel Anchor Bolts, Nuts, and Washers: ASTM A 193/A 193M, Grade B8M, Type 316.

F. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.3 COLLECTION BOXES

A. Front-Loading, Collection Boxes: Consisting of single compartment with fire-resistant cushion bottom, enclosed within recessed wall box, with mail slot to receive mail. Provide access to compartment for collecting mail from front of unit. Comply with USPS Publication 16.

1. Manufacturers: Subject to compliance with requirements provide one of the following:
   a. Auth-Florence Manufacturing Co., A Florence Company; 4C Series.
   b. Salsbury Industries; 3700 Series.
2. Mounting: Recessed.
3. Type: Collection box.
4. Overall Height: Sized to match height of horizontal apartment mailboxes.
   a. Door Lock: Door prepared to receive lock furnished by local postmaster.
5. Compartment Frame and Front Panel: Fabricated from 1/8-inch- thick, smooth metal sheet.
6. Mail Slot: Fabricated from 1/4-inch- thick metal plate, with 11-inch-wide by 1-1/4-inch- high opening, protected by inside hood and hinge flap, and with inside baffle to prevent removal of mail from box.
7. Style: Compartment and hopper door set within face frame.
8. Concealed Components and Mounting Frames: Aluminum or steel sheet.
9. Identification: Engrave face of unit with 1-inch- high letters as follows: "LETTERS" on 2 lines at top of unit.
10. Finish: Finish surfaces exposed to view as follows:
    a. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer’s full range.

2.4 FABRICATION

A. Preassemble postal specialties in shop to greatest extent possible to minimize field assembly. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs, and safe to touch.

B. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

C. Drill or punch holes required for fasteners and remove burrs. Use security fasteners where fasteners are exposed. If used, seal external rivets before finishing.

D. Comply with AWS for recommended practices in shop welding. Provide welds behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces.

E. Fabricate doors of postal specialties to preclude binding, warping, or misalignment.

F. Fabricate rack ladders to support five mailbox modules to form a column of units.

G. Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturers of dissimilar metals.

2.5 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: 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 substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, roughing-in openings, clearances, and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine walls for suitable conditions where recessed units will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install postal specialties level and plumb, according to manufacturer's written instructions and roughing-in drawings.

1. Metal Protection: Where aluminum and copper alloys will contact grout, concrete, masonry, wood, or dissimilar metals, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturers of dissimilar metals.
2. Final acceptance depends on compliance with USPS requirements.

B. Horizontal Apartment Mailboxes: Install horizontal apartment mailboxes with center of tenant-door lock cylinder at the maximum and minimum heights above finished floor established by USPS and manufacturer's written instructions.

1. Install keyed-in door lock cylinders.

2. Install two rack ladders for the first column of apartment mailboxes and one rack ladder for each additional adjacent column of apartment mailboxes.

C. Collection Boxes: Install collection boxes with bottom of mail slots not more than 48 inches above finished floor.

3.3 FIELD QUALITY CONTROL

A. Arrange for USPS personnel to test collection boxes after installation according to USPS regulations.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as postal specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of postal specialty installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace postal specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by postal specialty manufacturer.

E. Replace postal specialties that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 105500.13

SECTION 105626.13 – CLOSET SHELVING 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. Integrated system of support, brackets, shelving, hanging rods and accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal storage shelving.

B. Shop Drawings: For customized metal storage shelving. Include plans, elevations, sections, details, and attachments to other work. Include installation details of connectors, lateral bracing, and special bracing.

C. Samples for Initial Selection: For units with factory-applied color finishes. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For the following components, of size indicated below:

1. Shelf Bracket.
2. Shelves: Full size, but not more than 24 inches wide by 12 inches deep.
3. Connectors for closet rod to bracket: Full size.
4. Closet Rod: 12 inches in length.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For closet specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed installation of closet specialties similar in material, design and extent to that indicated for this Project.

B. Source Limitations: Obtain closet specialties from single source from single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install metal storage shelving 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.

1.8 COORDINATION

A. Coordinate sizes and locations of blocking and backing required for installation of closet specialties attached to wall and ceiling assemblies.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

C. Steel Tubing: ASTM A 513, Type 2.

D. Particleboard: ANSI A208.1, made with binder containing no urea formaldehyde.

E. Wall Anchors: Manufacturer's standard, anchors designed to secure closet specialties to adjacent wall. Provide one per shelving unit for each shelving unit adjacent to a wall unless additional anchors are indicated in calculations.

2.2 CLOSET SYSTEM

A. Closet System.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Schulte Corporation; Freedom Rail Shelving System or comparable product by the following:

a. ClosetMaid; a division of Emerson Inc.
b. Rubbermaid: Product Fastrack.

B. Components:

1. Mounting Hardware: Patented Strong-Loc hollow wall anchor system.
2. Wall-Mount Uprights: Slotted vertical hanging channels. Heavy-duty steel, .071 inch grade 1008, coated with a non-stick epoxy coating.
    a. Length: As indicated on Drawings.
3. Shelving:
    a. Width: 12 inches unless otherwise indicated.
4. Brackets: Heavy-duty steel, .065 inch grade 1008, coated with a non-stick epoxy coating.
    a. Hanging Chrome Rods and Rod Stops: Chrome plated steel tubing. Hanging chrome rods shall be mounted under shelf as indicated.
5. Hanging Rod: Heavy-duty Chrome Plated.
    a. Hanging Chrome Rods: Chrome plated steel tubing. Hanging Chrome rods shall be mounted under shelf as indicated.
6. Rod Stops: Heavy-duty steel, Chrome plated.
    a. Chrome plated Rod Stops lock into all Hanging Rods to prevent material from falling off of the end.

2.3 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" 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.

2.4 STEEL FINISHES

A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling."

B. 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 thickness.

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 the Work.

B. Examine walls to which shelving will be attached for properly located blocking, grounds, or other solid backing for attachment of support fasteners.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install closet specialties in accordance with manufacturer's written instructions.

B. Install closet specialties level, plumb, square, rigid, true, and with shelves flat and free of distortion.

3.3 ADJUSTING

A. Adjust closet specialties so that connectors and other components engage accurately and securely.

B. Touch up marred finishes or replace metal storage shelving that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal storage shelving manufacturer.

C. Replace closet specialties that have been damaged or has deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 105626.13

SECTION 107100 - EXTERIOR SHUTTERS

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. Section Includes:

1. Aluminum exterior shutters.

B. Related Sections include the following:

1. Section 061053 “Miscellaneous Rough Carpentry.”
2. Section 074646 “Fiber Cement Siding.”
3. Section 079200 "Joint Sealants.”
4. Section 092400 “Cement Plastering.”

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets and detail drawings for each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Product literature.
4. Installation methods.

B. Shop Drawings: Show materials, layout, dimensions, profiles, fasteners and anchors, hardware, finishes, and interface with adjacent construction.

1. Structural Performance: Provide engineering analysis indicating fastener requirements for wind loading.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square, representing actual product, color, and patterns.

E. Current Florida Building Products Approval or Miami-Dade Notice of Acceptance (NOA) for exterior locations only.

1.4 QUALITY ASSURANCE

A. Single Source Requirements: Provide shutter and installation accessories as supplied by a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.

B. Store products indoors in manufacturers or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer. Protect from damage.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install systems under environmental conditions outside manufacturer's recommended limits.

1.7 WARRANTY

A. Manufacturer's Standard Limited Warranty: 1 year for materials and workmanship

2.- PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Sundance Architectural Shutters.

1. Product: Flat (Colonial Style) Hurricane Shutter.
2. Product: Bahama Shutter.

2.2 PERFORMANANCE REQUIREMENTS

A. Large Missile Impact: Florida Building Code TA5 20a and ASTM Et886/1996.

B. Uniform Static Load Test: Florida Building Code TAS 202 and ASTM E 330.

C. Cycle Load Test: Florida Building Code TAS 203 and ASTM E1886/1996.

2.3 MATERIALS

A. General: Build Out Frame and Shutter(s); shutter hinges are on the sides (jambs) attached to the build out frame.

B. Material: Aluminum alloy, 6063-T53 and 6005 tube, flat bar and rod; architectural angle assembly.

C. Build out Frame: Miter cut corners, weld miter cut at the front and back surface.

D. Shutter Leaf:

1. Shutter Frame: 2” x 1 ½” x 1/8” rectangular tube. Miter cut corners, weld miter cut corners; weld miter cut front and back surface.
2. Head/Sill Spacer: 1” x 1” x 1/8” square tube. Weld shutter frame head and sill st corners and middle at optional vertical mullion.
3. Weld Guides: I" x I“x 1/8" Architectural Angle (with stamped slots for slats/louvers): Weld at head, sill and 6” o.c. on the inside vertical surface of the shutter frame.
4. Vertical Mullion: 1 right hand and 1 left hand weld guides required at clear span over 20 ½”. Weld head and sill of the shutter frame.
5. Horizontal Mullion: 2” x 1 ½” x 1/8” rectangular tube. Weld to jamb of shutter frame.
6. Slates(Louvers): 2” flat bar slats are placed into the weld guide, welded to the inside jambs of the shutter frame and optional vertical mullion. Perpendicular opening between each 1/4:” x 1” fixed slat shall be 1/8”. Opening between each fixed slat angle is 1/8”.

E. Hinges: Width and number of hinges are governed by the design pressures and shall be determined by the design engineer.

F. Fasteners: Manufacturer’s standard.

2.4 FINISHES

A. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 2 mils.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

4.1 EXAMINATION AND PREPARATION

A. Inspect and prepare substrates and openings using the methods recommended by the manufacturer for achieving best result for the substrates and openings under project conditions.

B. Do not proceed with installation until substrates and openings have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

4.2 INSTALLATION

A. Install in accordance with manufacturers recommended installation instructions for project conditions. Install in proper relationship with adjacent construction. Test for proper operation and adjust until satisfactory results are obtained.

4.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 107100

SECTION 107313 - AWNINGS

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. Metal framed awning systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For awning system and accessories. Include plans, elevations, sections, details, and attachments to other Work.

C. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples for Initial Selection: For each type of fabric required. Samples to be 8 by 8 inches minimum.

E. Samples for Verification: For each type of fabric required. Samples to be 8 by 8 inches minimum.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2, "Structural Welding Code--Aluminum."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify openings to be covered by awnings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating awnings without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

1.6 WARRANTY

A. Special Warranty for Awning System: Manufacturer's standard form in which manufacturer agrees to repair or replace components of awning system installation that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Frame Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.

C. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

D. PVC Trim: Manufacturer's standard zip-strip and flash-strip.

2.2 AWNING FRAMEWORK

A. Basis-of-Design Product: Subject to compliance with requirements provide Steel Stitch; Staple-In.

2.3 AWNING FABRIC

A. Fire-Test-Response Characteristics: Provide awning fabrics with the fire-test-response characteristics indicated, as determined by testing identical products according to test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Resistance Ratings: Passes NFPA 701.
2. Permanently attach label to each awning fabric indicating whether fabric is inherently and permanently flame resistant or is treated with flame-retardant chemicals, and whether it requires retreatment after designated time period or cleaning.

B. Fabric Type: Polyester cotton with PVC top-coat.

C. Fabric Weight: 13.5 ounces minimum.

D. Color: As selected by Architect from manufacturer's full range.

2.4 FABRICATION, GENERAL

A. Assemble awning frames in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Include supports, anchorages, and accessories required for complete assembly.

2.5 ALUMINUM FINISHES

A. Paint System: Manufacturer's standard acrylic semigloss.

1. Color: SW 6494 Lakeshore.

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.

1. 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. Install awning system in accordance with manufacturer's recommendations.

B. Locate and place awnings level, plumb, and at indicated alignment with adjacent work.

C. 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.

D. Fabric to be tight and free of wrinkles. All panels to be of equal tension.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

3.4 ADJUSTING AND CLEANING

A. Clean exposed surfaces of awnings to remove soil during construction period. Do not let soil accumulate until final cleaning.

B. Restore awnings 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 107313

SECTION 107317 – FREE STANDING EXTRUDED ALUMINUM CANOPY SYSTEMS

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. Section includes:

1. Pre-finished free standing extruded aluminum canopy systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include construction details, material, descriptions, dimensions of individual components, data and installation instructions.

B. Shop Drawings: Submit complete shop drawings for fabrication and erection, including plans, elevations and large scale details of typical sections and connections

1. Provide layout, dimensions and identification of each unit corresponding to sequence of installation and erection procedures.
2. Provide location and details of anchorage devices to be embedded in or fastened to other construction. Furnish templates if required for accurate placement.
3. Include schedule and erection procedure for proper installation.
4. Provide complete design calculations prepared by and bearing the stamp of a professional engineer registered in the state in which the project is located.

C. Samples for Verification: For each type of exposed finish required in manufacturer's standard sizes.

D. Delegated-Design Submittal: For extruded aluminum canopy systems.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data for flagpoles to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. System Performance: Provide extruded aluminum 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 the local building code.

1. Live Load: As indicated on the structural drawings.
2. Wind Load: As indicated on the structural drawings.

B. Delegated Design: Design canopy and awning assemblies, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Manufacturer Qualifications: Obtain aluminum canopy covered walkway system from only one manufacturer, although several may be indicated as offering products complying with requirements.

1. Manufacturer shall have not less than 5 years' experience in the manufacture of extruded aluminum canopy systems of the type and quantity indicated.

D. Installer Qualifications: Install products of this Section by a company which has successfully specialized in installation of similar products for a period of not less than 2 years.

E. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting of work. However, allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay work.

F. Shop Assembly: Pre-assemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle protective cover system components as recommended by the manufacturer. Handle and store in a manner to avoid deforming members, excessive stresses and to protect finishes.

1.8 WARRANTY

A. Manufacturer shall warrant all manufacturer supplied components against defects in labor and materials for a period of one year commencing on the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Perfection Architectural Systems, Inc.

B. Other Acceptable Manufacturers:

1. Architectural Metal Systems.
2. Architectural Shade Products
3. Peachtree Protective Covers, Inc.

2.2 MATERIALS

A. Aluminum Extrusions: 6063 alloy, T-6 temper.

2.3 COMPONENTS

A. Struts:

1. Aluminum tubular extrusion, size as indicated on the drawings.

B. Gutter Beams:

1. Size: As indicated on the drawings.

C. Deck: Rigid-Roll-Lock extruded aluminum, self-flashing, interlocking sections.

1. Size and Profile: Soffit-style deck finish on underside as shown on drawings.

D. Fascia: Manufacturer's standard extruded aluminum fascia sections as shown on drawings and as required to complete the installation resulting in a neat finished appearance.

E. Flashing: Aluminum sheet, thickness as recommended by manufacturer for specific condition.

2.4 ACCESSORIES

A. Fasteners.

1. Deck Screws: No. 14 by 1 inch, self-tapping, Type 18-8 stainless steel with neoprene washers.
2. Trim Screws: No. 10 by 1/2 inch, self-tapping, Type 18-8 stainless steel.
3. Trim Rivets: Aluminum, size recommended by manufacturer for specific condition.
4. Other Fasteners: Type 18-8 stainless steel, type recommended by manufacturer for specific condition.

2.5 FABRICATION

A. Shop Assembly: Fabricate with corners mitered and heli-arc welded to the extent that completed pieces can be shipped on local, state, and federal highways without special permit. Provide bolted connections for elements required to be shipped unassembled.

2.6 FINISHES

A. Canopies to be powder coated to comply with NAAMM's “Metal Finishes Manual for Architectural and Metal Products”.

B. Pre-Assembly:

1. Kynar 500 from Manufacturers full range of colors to match color as indicated on Architectural drawings.

C. Coating Performance: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range of colors to match color as indicated on Architectural drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify locations and elevations.

B. Examine building surfaces to which canopy will connect.

C. Coordinate with responsible trade to perform corrective work on unsatisfactory footings or surfaces.

D. Commencement of work by installer is acceptance of existing conditions.

3.2 INSTALLATION

A. Erect protective covers in accordance with manufacturer's installation instructions.

B. Set plumb, straight, and true to line, adequately braced to maintain position until grout has cured.

C. Keep aluminum surfaces from direct contact with ferrous metal or other incompatible materials by applying one coat of clear acrylic coating.

3.3 CLEANING

A. Upon completion, clean all surfaces which have become soiled or coated as a result of work of this Section, using proper methods which will not scratch or otherwise damage finished surfaces.

1. For cleaning, use only products and techniques acceptable to manufacturer of products being cleaned.

B. Remove surplus materials and debris from the site.

3.4 PROTECTION

A. General: Institute protective procedures and install protective materials as required to ensure that work of this Section will be without damage or deterioration at substantial completion.

END OF SECTION 107317

SECTION 107318 – WALL HUNG EXTRUDED ALUMINUM CANOPY SYSTEMS

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. Section includes:

1. Pre-engineered, pre-finished wall hung extruded aluminum canopy sunshade system.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include construction details, material, descriptions, dimensions of individual components, data and installation instructions.

B. Shop Drawings: Submit complete shop drawings for fabrication and erection, including plans, elevations and large scale details of typical sections and connections

1. Provide layout, dimensions and identification of each unit corresponding to sequence of installation and erection procedures.
2. Provide location and details of anchorage devices to be embedded in or fastened to other construction. Furnish templates if required for accurate placement.
3. Include schedule and erection procedure for proper installation.
4. Provide complete design calculations prepared by and bearing the stamp of a professional engineer registered in the state in which the project is located.

C. Samples for Verification: For each type of exposed finish required in manufacturer's standard sizes.

D. Delegated-Design Submittal: For extruded aluminum canopy systems.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data for flagpoles to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. System Performance: Provide extruded aluminum 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 the local building code.

1. Live Load: As indicated on the structural drawings.
2. Wind Load: As indicated on the structural drawings.

B. Delegated Design: Design canopy and awning assemblies, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Manufacturer Qualifications: Obtain aluminum canopy covered walkway system from only one manufacturer, although several may be indicated as offering products complying with requirements.

1. Manufacturer shall have not less than 5 years' experience in the manufacture of extruded aluminum canopy systems of the type and quantity indicated.
2. Accessories: Provide accessory items only as produced or recommended by manufacturer of primary products.

D. Installer Qualifications: Install products of this Section by a company which has successfully specialized in installation of similar products for a period of not less than 3 years.

E. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting of work. However, allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay work.

F. Shop Assembly: Pre-assemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle protective cover system components as recommended by the manufacturer. Handle and store in a manner to avoid deforming members, excessive stresses and to protect finishes.

1.8 WARRANTY

A. Manufacturer shall warrant all manufacturer supplied components against defects in labor and materials for a period of one year commencing on the date of substantial completion.

B. Installer shall warrant entire scope of installation including connection of canopies to building, caulking or flashing of canopies and installation of decking panels, against defects in all labor and materials for a period of one year commencing on the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Perfection Architectural Systems, Inc.

B. Other Acceptable Manufacturers:

1. Architectural Metal Systems.
2. Architectural Shade Products
3. Peachtree Protective Covers, Inc.

2.2 MATERIALS

A. Aluminum Extrusions: 6063 alloy, T-6 temper.

2.3 COMPONENTS

A. Outriggers and Infill:

1. Radius-cornered aluminum tubular extrusion of size shown on drawings.

B. Tapered Fascia: Manufacturer's standard extruded aluminum fascia sections as shown on drawings and as required to complete the installation resulting in a neat, finished appearance.

C. Flashing: Aluminum sheet, thickness as recommended by manufacturer for specific condition.

2.4 ACCESSORIES

A. Fasteners.

1. Trim Screws: No. 10 by 1/2 inch, self-tapping, Type 18-8 stainless steel.
2. Trim Rivets: Aluminum, size recommended by manufacturer for specific condition.
3. Other Fasteners: Type 18-8 stainless steel, type recommended by manufacturer for specific condition.

2.5 FABRICATION

A. Shop Assembly: Fabricate assembly with corners mitered and heli-arc welded to the extent that completed assemblies can be shipped on local, state, and federal highways without special permit. Provide bolted connections for assemblies required to be shipped unassembled.

2.6 FINISHES

A. Outriggers, Infill and Fascia:

1. Thermo-Set Enamel: AA-C-12C-42R-1, comply with AAMA 603.

a. Color: Custom color as selected by architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine building surfaces to which canopy will connect.

B. Commencement of work by installer is acceptance of existing conditions.

3.2 INSTALLATION

A. Erect protective covers in accordance with manufacturer's installation instructions.

B. Keep aluminum surfaces from direct contact with ferrous metal or other incompatible materials by applying one coat of clear acrylic coating.

3.3 CLEANING

A. Upon completion, clean all surfaces which have become soiled or coated as a result of work of this Section, using proper methods which will not scratch or otherwise damage finished surfaces.

1. For cleaning, use only products and techniques acceptable to manufacturer of products being cleaned.

B. Remove surplus materials and debris from the site.

3.4 PROTECTION

A. General: Institute protective procedures and install protective materials as required to ensure that work of this Section will be without damage or deterioration at substantial completion.

END OF SECTION 107318

SECTION 107319 - EXTRUDED ALUMINUM CANOPY SYSTEMS

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. Section includes:

1. Extruded aluminum canopy systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include construction details, material, descriptions, and dimensions of individual components, data and installation instructions.

B. Shop Drawings: Submit complete shop drawings for fabrication and erection, including plans, elevations and large scale details of typical sections and connections to the building.

1. Provide layout, dimensions and identification of each unit corresponding to sequence of installation and erection procedures.
2. Provide location and details of anchorage devices to be embedded in or fastened to other construction. Furnish templates if required for accurate placement.
3. Include schedule and erection procedure for proper installation.
4. Provide complete design calculations prepared by and bearing the stamp of a professional engineer registered in the state in which the project is located.

C. Samples for Verification: For each type of exposed finish required in manufacturer's standard sizes.

D. Delegated-Design Submittal: For aluminum canopy systems, indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation

1.4 INFORMATIONAL SUBMITTALS

A. Provide manufacturer’s standard literature and specifications for canopies.

B. Submit engineered shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data for metal canopy

1.6 QUALITY ASSURANCE

A. System Performance: Provide extruded aluminum 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 the local building code.

1. Live Load: As indicated on the structural drawings.
2. Wind Load: As indicated on the structural drawings.

B. Manufacturer Qualifications: Obtain aluminum canopy covered walkway system from only one manufacturer, although several may be indicated as offering products complying with requirements.

1. Manufacturer shall have not less than 5 years' experience in the manufacture of extruded aluminum canopy systems of the type and quantity indicated.
2. Accessories: Provide accessory items only as produced or recommended by manufacturer of primary products.

C. Installer Qualifications: Install products of this Section by a company which has successfully specialized in installation of similar products for a period of not less than 3 years.

D. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting of work. However, allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay work.

E. Shop Assembly: Pre-assemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle protective cover system components as recommended by the manufacturer. Handle and store in a manner to avoid deforming members, excessive stresses and to protect finishes.

1.8 WARRANTY

A. Manufacturer shall warrant all manufacturer supplied components against defects in labor and materials for a period of one year commencing on the date of substantial completion.

B. Installer shall warrant entire scope of installation including connection of canopies to building, caulking or flashing of canopies and installation of decking panels, against defects in all labor and materials for a period of one year commencing on the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Perfection Architectural Systems, Inc.

B. Other Acceptable Manufacturers:

1. Architectural Metal Systems.
2. Architectural Shade Products.
3. Peachtree Protective Covers, Inc.

2.2 MATERIALS

A. Decking shall be interlocking, self-supporting (up to connection to gutters), 6” wide pans, flat on underside with 1-3/4” tall ribs; shall be 6063-T6 extruded aluminum; shall be leak free; shall attach to gutters as to direct water into gutter from each end as shown on drawings

B. Fascia shall be 6063-T6 extruded aluminum structural channel and trims to match profiles indicated in the Architectural drawings.

C. Gutters to be 6063-T6 extruded aluminum minimum 4” x 3-1/2” with minimum sidewall thickness of 1/8”. Gutters to form self-contained “loop” spanning back, sides and fronts of canopies.

D. Hanger rods shall be aluminum tubular extrusion of size shown on shop drawings. Hanger rods to have adjustable jaw style aluminum ends.

E. Fasteners shall be noncorrosive, nonstaining bolts, shims and accessory items.

2.3 FRAME FINISHES

A. Canopies to be powder coated to comply with NAAMM's “Metal Finishes Manual for Architectural and Metal Products”.

B. Pre-Assembly:

1. Kynar 500 from Manufacturers full range of colors to match color as indicated on Architectural drawings.

C. Coating Performance: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range of colors to match color as indicated on Architectural drawings.

2.4 FABRICATION

A. Aluminum Components shall be joined by welding in compliance with ASW standards. All members to be cut so as to form tight joints with no gaps.

1. Use clean, straight, smooth material that complies with approved plans and shop drawings.

B. Hanger Hardware:

1. Wall plates to be precision machined with beveled edges and radiused clevis plate as per approved drawings and manufacturer's product literature.
2. Hanger rods to be prefabricated assemblies straight and true, welded in compliance with ASW standards.

C. Decking panels to be prefinished, cut to length and width and marked for assembly.

2.5 ACCESSORIES

A. Deck Screws: No. 14 by 1 inch, self-tapping, Type 18-8 stainless steel with neoprene washers.

B. Trim Screws: No. 10 by 1/2 inch, self-tapping, Type 18-8 stainless steel.

C. Trim Rivets: Aluminum, size recommended by manufacturer for specific condition.

D. Other Fasteners: Type 18-8 stainless steel, type recommended by manufacturer for specific condition.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect substrates and conditions under which the work of this Section will be performed and verify that installation properly may commence.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the Work.

B. Erection: Follow manufacturer's instructions

C. Install roof deck sections, accessories, and related flashings 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.

D. Assemble all components in a neat, workmanlike manner.

3.3 CLEANING

A. Upon completion, clean all surfaces which have become soiled or coated as a result of work of this Section, using proper methods which will not scratch or otherwise damage finished surfaces.

1. For cleaning, use only products and techniques acceptable to manufacturer of products being cleaned.

3.4 PROTECTION

A. General: Institute protective procedures and install protective materials as required to ensure that work of this Section will be without damage or deterioration at substantial completion.

END OF SECTION 107319

SECTION 108200 - ALL-GLASS SHOWER DOORS

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. Section Includes:

1. All-glass shower doors and sidelights.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for all-glass shower door system.

B. Shop Drawings: Show fabrication and installation details, including the following:

1. Plans, elevations, and sections.
2. Details of fittings and glazing.
3. Door hardware locations, mounting heights, and installation requirements.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Finishes: 6-inch- long sections of accessory fittings, and other items.
2. Glass: 6 inches square, showing exposed-edge finish.
3. Door Hardware: For exposed door hardware of each type, in specified finish, full size.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Maintenance Data: For all-glass shower doors systems to include in maintenance manuals.

C. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain all-glass shower door systems from single source from single manufacturer.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with all-glass systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of all-glass systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion:

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Basco Shower Enclosures; Fusion Semi-Frameless ¼ inch Glass Swing Door and 3/8 inch Panel; Model 1435A.

2.2 MATERIALS

A. Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), tested for surface and edge compression per ASTM C 1048 and for impact strength per 16 CFR 1201 for Category II materials.

1. Class 1: Clear monolithic.
    a. Door Thickness: 1/4 inch.
    b. Sidelight Thickness: 3/8 inch.
2. Exposed Edges: Machine ground and flat polished.
3. Butt Edges: Flat ground.
4. Corner Edges: Lap-joint corners with exposed edges polished.

B. Aluminum Extrusions: ASTM B 221, with strength and durability characteristics of not less than Alloy 6063-T5.

2.3 METAL COMPONENTS

A. Fitting Configuration:

1. Manual-Swinging, All-Glass Shower Doors.

B. Rail Fittings:

1. Material: Aluminum Bronze-clad aluminum Brass-clad aluminum Stainless-steel-clad aluminum.

C. Anchors and Fastenings: Concealed.

2.4 DOOR HARDWARE

A. Pull-Towel Bar: As selected from manufacturers' full range.

B. Magnetic Latch: Manufacturer's standard.

C. Bottom Seal: Manufacturer's standard clear vinyl.

2.5 FABRICATION

A. Provide holes and cutouts in glass to receive hardware, fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.

1. Fully temper glass using horizontal (roller-hearth) process, and fabricate so that when glass is installed, roll-wave distortion is parallel with bottom edge of door or lite.

B. Factory assemble components and factory install hardware and fittings to greatest extent possible.

2.6 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M35C31A21/A44, Class II, 0.010 mm or thicker.

1. Color: Brushed nickel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine 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.

3.2 INSTALLATION

A. Install all-glass systems and associated components according to manufacturer's written instructions.

B. Set units level, plumb, and true to line, with uniform joints.

C. Maintain uniform clearances between adjacent components.

D. Lubricate hardware and other moving parts according to manufacturer's written instructions.

E. Install joint sealants as specified in Section 079200 "Joint Sealants".

3.3 ADJUSTING AND CLEANING

A. Adjust all-glass shower doors and hardware to produce smooth operation and tight fit at contact points and vinyl seal.

END OF SECTION 108200

SECTION 113100 - RESIDENTIAL 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. Section Includes:

1. Residential appliances.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of appliance, from manufacturer.

C. Field quality-control reports.

D. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 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 residential appliances from single source and each type of residential appliance from single manufacturer.

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.

D. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.7 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.

1. Warranty Period: One year from date of substantial completion.

PART 2 - PRODUCTS

2.1 RESIDENTIAL APPLIANCES

A. See Schedule indicated on the drawings and cutsheets attached to this Section.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Gas-Fueled Appliances: Certified by a qualified testing agency for each type of gas-fueled appliance according to ANSI Z21 Series standards.

C. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1.

2.3 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.

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. Examine walls, ceilings, and roofs for suitable conditions where overhead exhaust hoods and microwave ovens with vented exhaust fans will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: 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. 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.

D. Utilities: Comply with plumbing, mechanical and electrical requirements.

E. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

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 113100

SECTION 116300 – TELEVISION WALL MOUNTS

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. Television wall mounts with tilt mechanism assembly to support television monitor.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for metal support framing for front-projection screens.
2. Section 061053 "Miscellaneous Rough Carpentry" for wood backing for screen installation.
3. Section 091000 “Non-Load Bearing Metal Studs.”
4. Section 092900 “Gypsum Board.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Manufacturer's installation, operation, maintenance, and cleaning instructions.

B. Shop Drawings: Indicate dimensions, fabrication and installation details.

C. Selection Samples: Submit samples for each finish product specified, complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: Submit samples for each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For inclusion in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm with 5 years minimum successful experience manufacturing television wall mounts.

B. Installer Qualifications: Authorized and trained by the manufacturer to install systems required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 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.

1.8 WARRANTY

A. Provide Manufacturer’s standard five (5) year warranty beginning at the Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Peerless Industries, Inc.

1. Product: Peerless SmartMount DS-VW775.

B. Source Limitations for Television Wall Mounts: Obtain television wall mounts and accessories from single manufacturer. Obtain accessories, including necessary mounting hardware, from television wall mount manufacturer.

2.2 MATERIALS

A. Steel Sheet: Heavy gauge cold rolled steel.

B. Fine Tune Adjustment: 1.5” of travel on each x, y and z axis.

C. Maximum Load: 125 lbs.

D. Mounting Hardware: Provide manufacturer's standard mounting hardware including all trim accessories.

E. Finish: Black powder paint coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Install auxiliary structural supports required by manufacturer.

B. Coordinate requirements for blocking, construction of recesses.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Installation Hardware: Provide attachment hardware, fasteners, and other components of type, size, and spacing recommended by manufacturer for complete, functional, secure installation of screens.

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 116300

SECTION 118226 - FACILITY WASTE COMPACTORS

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 waste compactors.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss electrical, plumbing, and sprinkler roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review coordination of chute locations with waste compactors.
3. Review sanitary requirements for water bibs, floor drains, and grease traps if required for Project to reduce decomposition and odors.
4. Review haul routes of waste to the compactor, route of hauler's equipment, and protections along these routes that are specified elsewhere.
5. Review required testing, inspection, and certification procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties and accessories, and finishes.

B. Shop Drawings: For each waste compactor and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, 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. Dimension chute and diverter locations that interface with waste compactors.
4. Include location and installation details of automatic sprinkler in hopper of each chute-fed compactor.
5. Indicate equipment access points and required space for equipment service and operation.
6. Include setting drawings, templates, and instructions for installing anchor bolts and other anchorages.
7. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of waste compactor.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For waste compactors to include in operation and maintenance manuals.

B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

PART 2 - PRODUCTS

2.1 WASTE COMPACTORS

A. Waste Compactor: Manufacturer's standard vertical type stationary compactor, complying with requirements, and with components, options, and accessories needed to provide a complete, functional system.

1. Basis of Design Manufacturer and Product:

a. Compactors Inc.; Model 520A.

2. Waste-Compactor Standards: ANSI Z245.21 including appendices and NFPA 82.
3. Waste-Container Standards: ANSI Z245.30 and ANSI Z245.60.
4. WASTEC-Rated Size (Volume): Minimum 6.5 cu.ft.
5. Clear Top Opening: 24 inches L. by 26 inches W.
6. Compaction Force (M): 15,075 lbs.
7. Cycle Time: Maximum 16 seconds.
8. Ram Face: Minimum 32.8 psi.
9. Volume Displacement: 54.0 cy/hr.
10. Weight (without container): 1,650 lbs.
11. Electrical Characteristics:

a. Horsepower: 5 hp.
b. Voltage: 208/220/440 V, three phase, 4 wire.

12. Hydraulic Pump: 1-Stage.
13. Control System: 115V; Fused, AC.

14. Finish: Manufacturer's standard.
    a. Color: As selected by Architect from manufacturer's full range.
15. Deodorizing Device: Manufacturer's standard.

2.2 FABRICATION

A. Fabricate waste compactors with smooth, eased, exposed edges to prevent injury to persons in vicinity of the equipment.

B. Fabricate containers, hoppers, compaction chambers, unit bodies, and similar components of steel with welded joints. Reinforce with steel members sized and spaced to withstand impacts and pressures of normal operations and to prevent deformation.

C. Fabricate equipment with replaceable parts at points of normal wear.

D. Fabricate liquidtight compactor baffles to stop liquid from leaking out.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, clearances, service rough-ins, and other conditions affecting performance of the Work.

B. Examine walls, floors, and chutes for suitable conditions where each waste compactor will be installed.

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

A. Install each waste compactor according to manufacturer's written instructions, ANSI Z245.2, and ANSI Z245.21, including appendices.

B. Install automatic sprinkler in hopper of each chute-fed compactor according to NFPA 82.

C. Set waste compactors level, plumb, properly aligned, and securely in place. Anchor as required for secure operation.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform installation and startup checks according to ANSI Z245.21, Appendix D, "Tests for Evaluation of Equipment and Performance," and manufacturer's written instructions.
2. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.
3. Verify unrestricted access to each firefighting access door or hose connection required by ANSI Z245.21 and NFPA 82 for compactor container(s).
4. Verify correct locations, color coding, and legibility of caution, warning, and danger markings.
5. Certify compliance with test parameters.

B. A waste compactor will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, initial maintenance service shall include 12 months' full maintenance by skilled employees of waste-compactor Installer. Include monthly preventive maintenance, repair, or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper waste-compactor operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain waste compactors according to manufacturer's written instructions and ANSI Z245.2.

END OF SECTION 118226

SECTION 125450 – CABANAS

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:

1. Aluminum framing and fittings, including base plates and stainless steel hardware.
2. Covering material.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Provide data on aluminum frame, fabric covering, color fastness, attachment devices to framing system.

B. Shop Drawings: For cabana system and accessories. Include plans, elevations, sections, details, and attachments to other Work.

C. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples for Initial Selection: For each type of fabric required. Samples to be 8 by 8 inches minimum.

E. Samples for Verification: For each type of fabric required. Samples to be 8 by 8 inches minimum.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2, "Structural Welding Code--Aluminum."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify locations cabanas shall be installed by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating cabanas without

field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

1.6 WARRANTY

A. Provide the cabana structural materials with the manufacturer's standard 8 year warranty on all structural materials.

1. The structural integrity of the Cabana shall be warranted for one (1) year from the date of Substantial Completion.
2. The fabric and sewn composite shade covering shall have a full warranty for 5 years from the date of Substantial Completion.
    a. The fabric only is prorated for second 5-year term for a total of 10-year warranty.
    b. Pro-rata periods: 6th year = 80% coverage, 7th year = 60% coverage, 8th year = 40% coverage.
3. The product, when used in its designed capacity, must be guaranteed for a period of one (1) year from original installation against:
    a. The frame deteriorating under normal conditions.
    b. The frame deteriorating from faulty workmanship.
    c. Inappropriate design of supporting structure.
    d. Excessive loss of color in the fabric under normal exposure conditions, including sunlight, rot and normal atmospheric chemicals that may render it unserviceable.
    e. Any wearing or blowouts due to wind caused by improper installation or design. Under extreme wind conditions that exceed our design capacity, it is mandatory to remove the shade fabric from the structure.
4. Structures are not warranted for damages caused by storms, snowfall, cyclones, typhoons, or other acts of God. For cabanas not engineered for snow loads, the fabric must be removed during months when snow is expected.
5. All fabric tops shall be warranted for winds and gusts per engineering 3 second burst limit. The fabric warranty is void if winds or gusts are in excess of amount specified in approved plans.
6. The contractor reserves the right to repair or replace any item covered by the warranty.
7. Cabanas located in areas where they may be subject to damage during construction by handling, cleaning, etc. (i.e., painting, cleaning of concrete block) shall be protected and or removed from the location until the hazardous condition is terminated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Design, fabricate and install cabanas to withstand loads from gravity, wind, ponding, drift, and structural movement, including thermally induced movement and to resist, without failure, other conditions of in-service use, including exposure to weather. Cabana structures shall be designed by an engineer licensed in the state where the project is located.

1. Delegated Design: Design cabana assemblies, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Cabana assemblies shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Wind Loads: As indicated on the structural drawings.
2. Dead Loads: The weight of the cabana system.
3. Deflection: Deflection shall be L/180 for positive and negative loads.

2.2 ALUMINUM FRAMING SYSTEM

A. Framing: Fully welded frame structure shall consist of three inch square aluminum framing and shall be manufactured of 6063-T5 aluminum extrusions. Aluminum framing profiles shall be sized to withstand all live, dead and superimposed loads.

1. Frame size: 8’ x 8’.

B. Fittings and Elbows: Manufacturer’s standard aluminum framing.

C. Mounting: Base plates with stainless steel hardware.

D. Splice Connectors: Manufacturer’s standard aluminum framing.

E. Exposed Fasteners: Flush countersunk stainless steel screws or bolts; consistent with design of system.

F. Frame Finish: Powder Coat Finish.

1. General: All aluminum frame surfaces shall be powder coated to comply with "Metal Finishes Manual for Architectural and Metal Products".
2. Pre-Assembly: Before powder coating, cabana frames shall be fully assembled with welded joints, to the largest size that can be accommodated by the powder coat facility.
3. Coating Performance:
    a. When tested in compliance with ASTM D 3363-05, coating shall withstand a minimum gauge hardness of 2H.
    b. When tested in compliance with ASTM D 2794, pass up to 80 lbs.
    c. Coated frame shall have a minimum salt spray resistance of 500 hours using ASTM B 117, without loss of paint adhesion.
4. Finish/Color: As selected by the Architect from the manufacturer's full range of colors.

2.3 COVERING MATERIALS

A. Sunbrella Fabric: Manufacturer’s standard fabric covering; ultra-violet light, mildew and water, flame resistant treated; color as selected.

2.4 ACCESSORIES

A. Privacy Curtains: Manufacturer’s standard.

1. Color/Pattern: As selected by the Owner’s Interior Design Consultant.

B. Accent Curtains: Manufacturer’s standard.

1. Color/Pattern: As selected by the Owner’s Interior Design Consultant.

C. Fixed Aluminum Slats: Manufacturer’s standard.

1. Finish/Color: As selected by the Architect.

D. Vent Top: Manufacturer’s standard.

E. Fan/Light Bracket: Manufacturer’s standard.

F. Ceiling Fan: Manufacturer’s standard.

G. Convenience Receptacles: As indicated on the drawings.

2.5 FABRICATION - FRAMING

A. Fit and shop assemble components in largest practical sizes, for delivery to site.

B. Fabricate components with joints tightly fitted and secured.

C. Exposed Fastenings: Unobtrusively located; consistent with design of component, except where specifically noted otherwise.

D. Supply components required for anchorage of framing. Fabricate anchors and related components of same material and finish as framing, except where specifically noted otherwise.

E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

F. Accurately form components to suit each other and to building structure.

2.6 FABRICATION – COVERING

A. Fabricate panels and accessory items at factory, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

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.

1. 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. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Install cabana system in accordance with manufacturer's written recommendations.

B. Locate and place cabanas level, plumb, and/or at indicated alignment with adjacent work.

C. Provide anchors required for connecting framing to base structure as indicated on the drawings.

D. Field weld as indicated on drawings. Grind welds smooth. Touch-up welds with primer.

E. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

F. Install covering over framing members, without creases or folds. Attach covering and fasten securely.

G. Fabric to be tight and free of wrinkles. All panels to be of equal tension.

3.4 ADJUSTING AND CLEANING

A. Clean exposed surfaces of cabanas to remove soil during construction period. Do not let soil accumulate until final cleaning.

B. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

C. Restore cabanas 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.

3.5 MAINTENANCE

A. Maintenance:

1. Cabanas must be inspected and maintained monthly.
2. Both fabric and frames can be washed with a mixture of mild soap and water with a soft brush or sponge and rinsed after cleaning with fresh water. Do NOT use bleach or any acidic agents.

END OF SECTION 125450

SECTION 133123 – PRE-ENGINEERED FABRIC SHADE STRUCTURES

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 fabric shade structures, including membrane, structural supporting members, fittings, and accessories:

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Convene a pre-installation meeting two (2) weeks before start of installation of membrane structure. Require attendance of parties directly affecting work of this section, including Architect, Owner, Contractor, and installation superintendent. Review proper handling of membrane, preparation, installation, adjusting, cleaning, and coordination with other work.

1.4 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product data, including test reports on membrane showing compliance with specified properties, including detailed material and performance specifications for all fabric, steel, hardware and cables used in shade structure.

B. Shop Drawings: Submit construction drawings including plans, elevations, details, dimensions, support steel sizing, hardware, clamp/corner plates, fittings, membrane, and membrane layout seams. Include:

1. Exact interface geometry determination and definitions.
2. Coordination between membrane and structural supports.
3. Interfaces to foundation supports.
4. Design loads used in structural calculations.
5. Stamp or seal of design engineer.

C. Samples: Submit the following:

1. 2 full sets of fabric samples.
2. 2 full sets of powder coating color metal “chips”.

D. Erection/Stressing Plan: Submit a comprehensive erection and stressing plan, including drawings and sketches that clearly show the proposed erection procedure for the membrane elements and structural steel during each stage of construction.

E. Quality Control: Submit outline of manufacturer's Quality Control Program.

F. Safety Program: Submit copy of manufacturer's safety manual for installation.

G. Operating and Maintenance Data: Manufacturer's instructions for membrane repair and cleaning membrane

H. Delegated-Design Submittal: For tensioned membrane canopy system, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm that is capable of assuming complete responsibility for design, engineering, fabrication, delivery, preparation, installation, adjusting, and cleaning of structure, and:

1. Having minimum of 5 years' experience in design and fabrication of membrane structures of similar size and complexity to that specified.
2. Delegated Design: Delegated design engineer for the tensioned membrane structure, shall provide comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated, licensed in the state where the project is located.
3. Employing a professional staff and qualified consultants experienced with membrane structures of similar size and complexity to that specified.
4. Employing integrated CAD and finite element computer software programs to ensure adequacy of design and accurate 3-dimensional computer generated models for fabrication of structure; using the CAD system to prepare construction drawings and interface with the plotting and cutting process, ensuring high precision membrane cutting.
5. Providing installation directly supervised by a superintendent, directly employed by the contractor, with 5 years of experience in installation of tensioned membrane structures of similar size and complexity to that specified.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane structure manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1. With minimum five years documented experience.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockup for each profile as shown on Drawings.
    a. Include typical components, attachments to building structure, and methods of installation.
    b. Do not proceed with remaining work until workmanship, color and sheen are approved by Architect.
    c. Rework mock-up areas as required to produce acceptable work.

2. 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. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in accordance with manufacturer's instructions, in a clean, dry, well ventilated area, above ground on blocking, and do not allow materials to become wet, stained, or dirty.

C. Handle materials so as to protect materials, coatings, and finishes during handling and installation to prevent damage or staining.

1. Handle membrane in accordance with manufacturer's instructions.
2. Use care in handling of membrane to avoid damage to fabric material.

1.8 PROJECT CONDITIONS

A. Do not install products under environmental conditions outside manufacturer’s recommendations.

B. Field Measurements: Verify actual measurements and openings by field measurements before fabrication. Show recorded measurements or shop drawings.

1.9 WARRANTY

A. Provide the pre-engineered fabric shade structure manufacturer's standard 12-month warranty on all labor and materials.

B. A supplemental warranty from the manufacturer shall be provided for a period of 10 years (pro-rated) on fabric and 10 years on the structural integrity of the steel, from date of substantial completion.

C. The warranty shall not deprive the Owner of other rights the Owner may have under the 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.

D. Fabric Warranty: Provide manufacturer’s standard 8-year limited manufacturer’s warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Shade Structures, Inc., d/b/a USA SHADE & Fabric Structures.

2.2 MEMBRANE STRUCTURES

A. Membrane Fabric Structure: The fabric shade membrane and structure shall be the size and height as indicated on the drawings.

B. The structures shall be manufactured by Shade Structures, Inc., d/b/a USA SHADE & Fabric Structures.

C. The fabric shade structure(s) shall conform to the current adopted version of the Florida Building Code.

D. All fabric shade structures are designed and engineered to meet the minimum of 115mph “Ultimate” Wind Load, Risk Category II, Exposure C, and a Live Load of 5psf. All fabric shade structures shall be engineered with a zero wind pass-through factor on the fabric.

2.3 MATERIALS

A. Steel:

1. All steel members of the fabric shade structure shall be designed in strict accordance with the requirements of the “American Institute of Steel Construction” (AISC) Specifications and the “American Iron and Steel Institute” (AISI) Specifications for Cold-Formed Members and manufactured in a IAS- (International Accreditation Service) accredited facility for Structural Steel Fabrication under IBC 2006 Section 1704.2.5.2.
2. All connections shall have a maximum internal sleeving tolerance of .0625” using high-tensile strength steel sections with a minimum sleeve length of 6”.
3. All non-hollow structural steel members shall comply to ASTM A-36. All hollow structural steel members shall be cold-formed, high-strength steel and comply with ASTM A-500-10, Grade B. All steel plates shall comply with ASTM A-572, Grade 50. All galvanized steel tubing shall be triple-coated for rust protection using an in-line electroplating coat process. All galvanized steel tubing shall be internally coated with zinc and organic coatings to prevent corrosion.

B. Bolts:

1. All structural field connections of the shade structure shall be designed and made with high-strength bolted connections using ASTM A-325, Grade B.
2. Where applicable, all stainless steel bolts shall comply with ASTM F-593, Alloy Group 1 or 2. All bolt fittings shall include rubber washers for water-tight seal at the joints. All nuts shall comply with ASTM F-594, Alloy Group 1 or 2.

C. Welding:

1. All shop-welded connections of the fabric shade structure shall be designed and performed in strict accordance with the requirements of the “American Welding Society” (AWS) Specifications. Structural welds shall be made in compliance with the requirements of the “pre-qualified” welded joints, where applicable and by certified welders. No onsite or field welding shall be permitted.
2. All full penetration welds shall be continuously inspected by an independent inspection agency and shall be tested to the requirement of IBC.

D. Powder Coating:

1. Galvanized steel tubing preparation prior to powder coating shall be executed in accordance with solvent cleaning SSPC-SP1. Solvents such as water, mineral spirits, xylol, and toluol, which are to be used to remove foreign matter from the surface. A mechanical method prior to solvent cleaning, and prior to surface preparation, shall be

executed according to Power Tool Cleaning SSPC-SP3, utilizing wire brushes, abrasive wheels, needle gun, etc.

2. Carbon structural steel tubing preparation prior to powder coating shall be executed in accordance with commercial blast cleaning SSPC-SP6 or NACE #3. A commercial blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, mill scale, rust, coating, oxides, corrosion, and other foreign material.
3. Powder coating shall be sufficiently applied (minimum 3 mils thickness) and cured at the recommended temperature to provide proper adhesion and stability to meet salt spray and adhesion tests, as defined by the American Society of Testing Materials.
4. Raw powder used in the powder coat process shall have the following characteristics:

    a. Specific gravity: 1.68 +/- 0.05
    b. Theoretical coverage: 114 +/- 4ft^2/mil
    c. Mass loss during cure: <1%
    d. Maximum storage temperature: 80^{o}F
    e. Interpon® 800 is a high-durability TGIC powder coating designed for exterior exposure. Tested against the most severe specifications, Interpon 800 gives significantly improved gloss retention and resistance to color change.

5. When the fabric shade structure(s) will be located within 10 miles of the ocean or in other potentially corrosive environments (pools, reclaimed water irrigation, other standing bodies of water) hot dip galvanizing of Carbon steel will be required.
6. When fabric shade structures are within 10-15 miles rust protection undercoat primer will be required on all structures. Sherwin-Williams® POWDURA® epoxy powder coating Z.R Primer shall be applied to Carbon steel in accordance with the manufacturer's specifications. Primer should be fused only and then top coated with the selected powder coat to ensure proper inter-coat adhesion.

    a. The primer's attributes shall be:

        1) Specific gravity (g/ml): 2.37.
        2) Coverage at 1.0 mil (ft^2/lb): 81.6.
        3) Adhesion: ASTM D-3359 5B.
        4) Flexibility: ASTM D-552 Pass 1/8".
        5) Pencil hardness: ASTM D-3363 H-2H.
        6) Impact resistance (in.lb): ASTM D-2794 Dir & Rev, 120 in-lbs.
        7) Salt spray resistance: ASTM B-117 2000 hours.
        8) Humidity resistance: ASTM D-4585 2000 hours.
        9) 60° Gloss: ASTM D-523 50 ~ 70.
        10) Cure schedule (metal temp): 10min @ 200°C (390°F).
        11) Film thickness range (mils): 2.0 ~ 3.0.

E. Tension Cable: Steel wire rope cable is determined based on calculated engineering loads. Standard cabling is galvanized. Stainless steel cabling required when hot dip galvanized frame or primer frame are required.

1. 0.25" (nominal) galvanized 7x19 strand core wire rope shall be used for tension loads up to 4,500 lbs.
2. 0.375" (nominal) galvanized 7x19 strand core wire rope shall be used for tension loads up to 9,000 lbs.
3. 0.5" (nominal) galvanized 6x19 strand core wire rope shall be used for tension loads up to 13,500 lbs.

F. Fabric Roof Systems:

1. Shade Fabric:

a. Basis of Design Manufacturer and Product: Weblon Vanguard Architectural Awning Fabric as manufactured by Herculite Products, Inc.
b. Composition and Materials:
    1) Face layer PVC film formulation.
    2) PVC-based high flex multi-function package.
    3) Core stabilized polyester fabric.
    4) PVC-based high flex multi-functional adhesive.
    5) Reverse layer PVC film formulation package.
c. Fabric shall meet the following flame spread and fire propagation tests:
    1) ASTM E-84 Class A for surface burning characteristics of building materials.

2. Color: As selected by the Architect from the Manufacturers full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine area to receive structure. Notify Architect if area is not acceptable. Do not begin installation until unacceptable conditions have been corrected.

B. Examine foundations and anchor bolts for location and elevation. Notify Architect of inaccuracies. Do not begin installation until unacceptable conditions have been corrected.

3.2 PREPARATION

A. Prepare an erection plan for all structural and fabric installation activity, including a detailed sequence of the work.

B. Protect adjacent work areas and finish surfaces from damage during installation.

C. Prepare a clear, flat, smooth, and clean layout area on ground of sufficient size for assembly of membrane panels. Prepare area adjacent to location of structure installation.

D. Check contact surfaces to remove sharp objects, dirt, grease, oil, and other causes for rips, scratching, or other damage to fabric panels during installation.

E. Use temporary ground sheets where fabric panels are to be dragged across a surface. Prevent chaffing or other damage to fabric panel surface.

3.3 INSTALLATION

A. The installation of fabric shade structures shall be performed by manufacturer or manufacturer-approved contractor. All installation personnel must have experience in the erection of tensioned fabric structures.

B. The installation shall comply with the manufacturer’s instructions for assembly, installation, and erection, per approved drawings.

C. Concrete:

1. Unless noted otherwise for footings and piers by the Project Engineer, the concrete specification for footings, piers, slabs, curbs, and walkways shall meet a minimum 3,000psi at 28-day strength.
2. Concrete work shall be executed in accordance with the latest edition of American Concrete Building Code ACI 318-14.
3. Concrete specifications shall comply in accordance with the Section 03300 Cast-in-Place Concrete, detailed as per plans, and shall be as follows:

    a. 28 Days Strength F'c = 3000 psi.
    b. Aggregate: HR.
    c. Slump: 3 ~ 5 inch.
    d. Portland Cement shall conform to C-150.
    e. Aggregate shall conform to ASTM C-33.

4. All reinforcement shall conform to ASTM A-615 grade 60.
5. Reinforcing steel shall be detailed, fabricated, and placed in accordance with the latest ACI Detailing Manual and Manual of Standard Practice.
6. Whenever daily ambient temperatures are below 80 degrees Fahrenheit, the contractor may have mix accelerators and hot water added at the batch plant (See Table 1).
7. The contractor shall not pour any concrete when the daily ambient temperature is to be below 55 degrees Fahrenheit.

TABLE 1

Temperature Range	% Accelerator	Type Accelerator
75~80 degrees F	1%	High Early (non calcium)
70~75 degrees F	2%	High Early (non calcium)
Below 70 degrees F	3%	High Early (non calcium)

D. Foundations:

1. All anchor bolts set in new concrete shall comply with ASTM F1554 GR 55.
2. All anchor bolts set in new concrete shall comply with ASTM F1554 GR 55.
3. Footings and full rebar cages shall be drilled, set, and poured as per manufacturer's specifications.

3.4 FIELD QUALITY CONTROL

A. Membrane Manufacturer's Field Services: Provide field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with instructions.

B. Replace damaged products.

1. Exception: Field repairs of minor damage to finishes are permitted only when approved in writing by Architect, panel manufacturer, and fabricator.
2. Field Repairs to Finishes: Using materials and methods sufficient that repairs are not discernible when viewed at distance of 10 feet under all typical light conditions experienced at the project.

3.5 ADJUSTING

A. Make final adjustments to structure as required for structural integrity, geometric shape, and free from objectionable wrinkles when viewed from the normally occupied space.

3.6 CLEANING AND PROTECTION

A. Clean structure in accordance with pre-engineered fabric shade structure manufacturer's instructions.

END OF SECTION 133123

SECTION 142123.16 - MACHINE-ROOM-LESS ELECTRIC TRACTION ELEVATORS

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. Section includes machine-room-less electric traction passenger and service elevators.

B. Products Supplied but Not Installed Under this Section:

1. Hoist Beam.
2. Pit Ladder.
3. Inserts mounted in block walls for rail attachments.

C. Work Supplied Under Other Sections:

1. Temporary lighting, including temporary lighting in hoistway for machine space with switch located in hoistway on the strike jamb side of top landing door.
2. Main line disconnects for each elevator:
    a. One fused three phase permanent power in building electrical distribution room.
3. Hoistway ventilation shall be in accordance with local and national building code requirements.
4. Guide Rail Support shall be structurally adequate to extend from pit floor to top of hoistway, with spans in accordance with requirements of authority having jurisdiction and final layouts.
5. Removable barricades at all hoistway openings, in compliance with OSHA 29 CFR 1926.502 in addition to any local code requirements.
6. Lifeline attachments capable of withstanding 5000 lb load in accordance with OSHA 29 CFR 1926.502. Provide a minimum of 2 at the top, front of each hoistway.
7. Pit lighting: Fixture with switch and guards. Provide illumination level equal to or greater than that required by ASME A17.1/CSA B44 2000, or applicable version.
8. Control space lighting with switch. Coordinate switch with lighting for machine space as allowable by code.
9. Access Doors: As required for access to governor and/or seismic switch. Access door shall be self-closing, self-locking if necessary and operable from the inside without a key.

D. Related Sections:

1. Section 015000 – Temporary Facility and Controls.
2. Section 033000 - Cast-in-Place Concrete.
3. Section 042000 - Unit Masonry.
4. Section 055000 - Metal Fabrications.
5. Division 23 - Heating, Ventilating, and Air Conditioning.
6. Division 260000 – Electrical.

1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product literature for each proposed system.

1. Cab design, dimensions and layout.
2. Layout, finishes, and accessories and available options.
3. Controls, signals and operating system.
4. Color selection charts for cab and entrances.

B. Shop Drawings:

1. Clearances and travel of car.
2. Clear inside hoistway and pit dimensions.
3. Location and layout of equipment and signals.
4. Car, guide rails, buffers and other components in hoistway.
5. Maximum rail bracket spacing.
6. Maximum loads imposed on building structure.
7. Hoist beam requirements.
8. Location and sizes of access doors.
9. Location and details of hoistway door and frames.
10. Electrical characteristics and connection requirements.

C. Operation and maintenance data:

1. Provide manufacturer's standard maintenance and operation manual.

D. Samples for Initial Selection: For finishes involving color selection.

E. Samples for Verification: For exposed finishes of cars, hoistway doors and frames, and signal equipment; 3-inch-square Samples of sheet materials; and 4-inch lengths of running trim members.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Provide manufacturer's standard maintenance and operation manual.

1. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

B. Diagnostic Tools:

1. Prior to seeking final acceptance for the completed project as specified by the Contract Documents, the Elevator Contractor shall deliver to the Owner any specialized tool(s) that may be required to perform diagnostic evaluations, adjustments, and/or parametric software changes and/or test and inspections on any piece of control or monitoring equipment installed.
2. This shall include any specialized tool(s) required for monitoring, inspection and/or maintenance where the means of suspension other than conventional wire ropes are furnished and installed by the Elevator Contractor. Any and all such tool(s) shall become property of the Owner. Any diagnostic tool provided to the Owner by the Elevator Contractor shall be configured to perform all levels of diagnostics, systems adjustment and parametric software changes which are available to the Elevator Contractor.
3. In those cases where diagnostic tools provided to the Owner require periodic recalibration/or re-initiation, the Elevator Contractor shall perform such tasks at no additional cost to the Owner for a period equal to the term of the maintenance agreement from the date of final acceptance of the competed project During those intervals in which the Owner might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation, or repair, the Elevator Contractor shall provide a temporary replacement for the tool at no additional cost to the Owner.
4. The Elevator Contractor shall deliver to the Owner, printed instructions for the proper use of any tool that may be necessary to perform diagnostic evaluations, system adjustment, and/or parametric software changes on any unit of microprocessor-based elevator control equipment and means of suspension other than standard elevator steel cables furnished and install by the Elevator Contractor.
5. Accompanying the printed instructions shall be any and all access codes, password, or other proprietary information that is necessary to interface with the microprocessor-control equipment.

C. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

D. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner in the form of a standard one-year maintenance agreement starting on date initial maintenance service is concluded. State services, obligations, conditions and terms of agreement period and for future renewal options.

1.6 QUALITY ASSURANCE

A. Manufacturer: Minimum of fifteen years' experience in the fabrication, installation and service of elevators of the type and performance of the specified. The manufacturer shall have a documented quality assurance program.

B. Installer Qualifications: The equipment manufacturer shall install the elevator.

C. Inspection and Testing: In accordance with requirements of local jurisdiction, obtain required permits, inspections and tests.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging.

B. If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the General Contractor shall be responsible for the cost of storage at an approved facility. Additional labor costs for double handling will be the responsibility of the General Contractor.

C. Delivered elevator materials shall be stored in a protected environment in accordance with manufacturer recommendations. A minimum storage area of 10 feet by 20 feet is required adjacent to the hoistway.

1.8 WARRANTY

A. Provide manufacturer warranty for a period of one year. The warranty period is to begin upon final acceptance of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

1.9 MAINTENANCE SERVICE

A. The elevator manufacturer shall provide maintenance service consisting of regular examinations and adjustments of the elevator equipment for a period of 12 Months after date of Substantial Completion.

B. Predictive maintenance shall be included for the full maintenance period. This service must be capable of using AI-based analytics to identify potential equipment issues and notifying the elevator provider via an internet connection.

C. Replacement parts shall be produced by the original equipment manufacturer.

D. Maintenance service to be performed during regular working hours of regular working days and shall include emergency call back service during regular working hours.

E. Maintenance service shall not include adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Manufacturer and Product: MonoSpace 500 DX MRL elevators by KONE, Inc.

B. Source Limitations: Obtain elevators from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Car Performance:

1. Car Speed ± 5% of contract speed under any loading condition or direction of travel.
2. Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.

B. System Performance:

1. Vertical Vibration (maximum): 15 mg ISO187338/ISO 8041 system pk – pk.
2. Horizontal Vibration (maximum): 12 mg ISO187338/ISO 8041 system pk – pk.
3. Jerk Rate (maximum): 3.3 ft/sec3.
4. Acceleration (maximum): 1.3 ft/sec2.
5. In Car Noise: 55 dB(A) Maximum.
6. Leveling Accuracy: ±0.2 inches.
7. Starts per hour (maximum): 240.

2.3 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator #1 Description:

1. Elevator Equipment: KONE MonoSpace 500DX MRL elevator.
2. Equipment Control: KCM831.
3. Quantity of Elevators: As indicated on the drawings.
4. Landings: As indicated on the drawings.
5. Openings: As indicated on the drawings.
6. Travel: As indicated on the drawings.
7. Rated Capacity: 4000 lbs.
8. Rated Speed: 150 fpm.
9. Clear Inside Dimensions (W x D): As indicated on the drawings.
10. Door Height: 7'-0".
11. Cab Height: 9'.
12. Clear height under suspended ceiling: 8'-5".
13. Entrance Width and Type: 42" and Left Opening.
14. Main Power Supply: 480 V Volts + 5%, three-phase.
15. Operation: Single-Car Standby Power Operation (10-D4A).
16. Machine Location: Inside the hoistway mounted on car guide rail.
17. Control Space Location: Integrated control.
18. Elevator Equipment shall conform to the requirements of seismic zone: Non-Seismic.
19. Maintenance Service Period: 12 Months.

C. Elevator #2 Description:

1. Elevator Equipment: KONE MonoSpace 500DX MRL elevator.
2. Equipment Control: KCM831.
3. Quantity of Elevators: As indicated on the drawings.
4. Landings: As indicated on the drawings.
5. Openings: As indicated on the drawings.
6. Travel: As indicated on the drawings.
7. Rated Capacity: 3500 lbs.
8. Rated Speed: 150 fpm.
9. Clear Inside Dimensions (W x D): As indicated on the drawings.
10. Door Height: 7'-0".
11. Cab Height: 9'.
12. Clear height under suspended ceiling: 8'-5".
13. Entrance Width and Type: 42" and Center Opening.
14. Main Power Supply: 480 V Volts + 5%, three-phase.
15. Operation: Single-Car Standby Power Operation (10-D4A).

16. Machine Location: Inside the hoistway mounted on car guide rail.
17. Control Space Location: Integrated control.
18. Elevator Equipment shall conform to the requirements of seismic zone: Non-Seismic.
19. Maintenance Service Period: 12 Months.

D. Elevator #3 Description:

1. Elevator Equipment: KONE MonoSpace 500DX MRL elevator.
2. Equipment Control: KCM831.
3. Quantity of Elevators: As indicated on the drawings.
4. Landings: As indicated on the drawings.
5. Openings: As indicated on the drawings.
6. Travel: As indicated on the drawings.
7. Rated Capacity: 4000 lbs.
8. Rated Speed: 150 fpm.
9. Clear Inside Dimensions (W x D): As indicated on the drawings.
10. Door Height: 7’-0”
11. Cab Height: 9'.
12. Clear height under suspended ceiling: 8'-5".
13. Entrance Width and Type: 42" and Left Opening.
14. Entrance Height: 8'-0”.
15. Main Power Supply: 480 V Volts + 5%, three-phase.
16. Operation: V).
17. Machine Location: Inside the hoistway mounted on car guide rail.
18. Control Space Location: Integrated control.
19. Elevator Equipment shall conform to the requirements of seismic zone: Non-Seismic.
20. Maintenance Service Period: 12 Months.

E. Elevator #4 Description:

1. Elevator Equipment: KONE MonoSpace 500DX MRL elevator.
2. Equipment Control: KCM831.
3. Quantity of Elevators: As indicated on the drawings.
4. Landings: As indicated on the drawings.
5. Openings: As indicated on the drawings.
6. Travel: As indicated on the drawings.
7. Rated Capacity: 3500 lbs.
8. Rated Speed: 200 fpm.
9. Clear Inside Dimensions (W x D): As indicated on the drawings.
10. Door Height: 7’-0”.
11. Cab Height: 9'.
12. Clear height under suspended ceiling: 8'-5".
13. Entrance Width and Type: 42" and Left Opening.
14. Main Power Supply: 480 V Volts + 5%, three-phase.
15. Operation: Single-Car Standby Power Operation (10-D4A).
16. Machine Location: Inside the hoistway mounted on car guide rail.
17. Control Space Location: Integrated control.
18. Elevator Equipment shall conform to the requirements of seismic zone: Non-Seismic.
19. Maintenance Service Period: 12 Months.

F. Elevator #5 Description:

1. Elevator Equipment: KONE MonoSpace 500DX MRL elevator.
2. Equipment Control: KCM831.

3. Quantity of Elevators: As indicated on the drawings.
4. Landings: As indicated on the drawings.
5. Openings: As indicated on the drawings.
6. Travel: As indicated on the drawings.
7. Rated Capacity: 4000 lbs.
8. Rated Speed: 200 fpm.
9. Clear Inside Dimensions (W x D): As indicated on the drawings.
10. Door Height: 7'-0".
11. Cab Height: 9'.
12. Clear height under suspended ceiling: 8'-5".
13. Entrance Width and Type: 42" and Left Opening.
14. Main Power Supply: 480 V Volts + 5%, three-phase.
15. Operation: Single-Car Standby Power Operation (10-D4A).
16. Machine Location: Inside the hoistway mounted on car guide rail.
17. Control Space Location: Integrated control.
18. Elevator Equipment shall conform to the requirements of seismic zone: Non-Seismic.
19. Maintenance Service Period: 12 Months.

2.4 CONTROL COMPONENTS AND CONTROL SPACE

A. Controller: Provide microcomputer based control system to perform all of the functions.

1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.
2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.
3. Provide a serial card rack and main CPU board containing a non-erasable EPROM and operating system firmware.
4. Variable field parameters and adjustments shall be contained in a non-volatile memory module.

B. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current.

C. Controller Location: Locate controller{s} in the front wall integrated with the top landing entrance frame, machine side of the elevator. One non-fused three phase permanent power in hoist way at top landing. A separate control space should not be required.

2.5 HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway.

B. Governor: Friction type over-speed governor rated for the duty of the elevator specified.

C. Buffers, Car and Counterweight: Polyurethane buffer.

D. Hoistway Operating Devices:

1. Emergency stop switch in the pit.

2. Terminal stopping switches.
3. Emergency stop switch on the machine.

E. Positioning System: System consisting of magnets and proximity switches.

F. Guide Rails and Attachments: Steel rails with brackets and fasteners.

2.6 HOISTWAY ENTRANCES

A. Hoistway Entrances:

1. Sills: Extruded aluminum.
2. Doors: Hollow metal construction with vertical internal channel reinforcements.
3. Fire Rating: Entrance and doors shall be UL fire-rated for 1-1/2 hour.
4. Entrance Finish: Brushed Stainless Steel.
5. Entrance Markings Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.7 CAR COMPONENTS

A. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.

B. Platform: Platform shall be all steel construction.

C. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.

D. Steel Cab:

1. Car Wall Finish: As selected by the Architect from the manufacturer’s full range.
2. Car Front Finish: As selected by the Architect from the manufacturer’s full range.
3. Car Door Finish: As selected by the Architect from the manufacturer’s full range.
4. Ceiling: As selected by the Architect from the manufacturer’s full range.
5. Handrail: As selected by the Architect from the manufacturer’s full range.
6. Flooring: By others. (Not to exceed 2 sq ft & 1/2" finished depth).
7. Threshold: Aluminum.
8. Service Elevators Protective Pad Hooks and Quilted Fire Retardant Protective Pads: Pad to be hung from suspended ceiling.

E. Emergency Car Signals:

1. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.
2. Emergency Car Lighting: Provide emergency power unit employing a 12-volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
3. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

F. Ventilation: Manufacturer’s standard cab fan.

2.8 SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation.

1. Main Flush mounted car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have Amber Dot Matrix illumination (halo). All buttons to have raised text and Braille marking on left hand side. The car operating display panel shall be Amber Dot Matrix. All texts, when illuminated, shall be Amber Dot Matrix. The car operating panel shall have a Brushed Stainless Steel finish.
2. Additional features of car operating panel shall include:

a. Car Position Indicator within operating panel Brushed Stainless Steel.
b. Elevator Data Plate marked with elevator capacity and car number on car top.
c. Help button markings with raised markings.
d. In car stop switch per local code.
e. Firefighter's hat.
f. Firefighter's Phase II Key-switch.
g. Call Cancel Button.
h. Pre-programmed integrated ADA phone (complete description of krms features included as standard).
i. Help Button/Communicator. Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
j. Firefighter's Phase II emergency in-car operating instructions.

B. Hall Fixtures: Wall mounted hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a Brushed Stainless Steel finish.

1. Hall fixtures shall feature round, mechanical, buttons in applied mount face frame. Hall fixtures shall correspond to options available from that landing. Buttons shall be in a vertically mounted fixture.

C. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel, and a chime will sound. The chime will sound once for up and twice for down. The car riding lantern face plate shall have a Brushed Stainless Steel finish.

D. Combination Hall Position Indicator and Hall Lantern located at Lobby. Hall lanterns and hall indicators shall feature amber illumination, all numbers will be 7-segment amber display.

E. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed. For each elevator, provide illuminated signals that indicate when they are operational and when they are at the designated emergency return level with doors open.

F. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return

level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

G. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.9 ELEVATOR OPERATOR AND CONTROLLER

A. Elevator Operation:

1. Single-Car Standby Power Operation (10-D4A): On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby. Manual operation causes automatic operation to cease. When normal power is restored, the elevators automatically resume operation.
2. Group Standby Power Operation (10-D4A): On activation of standby power, cars are returned to a designated floor and parked with doors open. One car is returned at a time, with priority given to loaded cars. If a car cannot be returned after two attempts, it is removed from the system. When all cars have been returned or removed from the system, one car is automatically placed in service. If car selected for service cannot operate within 60 seconds, the system removes car from service and places another car in service. Manual operation causes automatic operation to cease. When normal power is restored, the elevators automatically resume operation.
3. Control Panel Operation: Single-Car and Group operated cars can be manually put in individual service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby. Control panel switch shall prevent multiple, simultaneous operation of elevators.

B. Standard Operating Features Shall Include:

1. Full Collective Operation.
2. Fan and Light Control.
3. Load Weighing Bypass.
4. Ascending Car Uncontrolled Movement Protection.
5. Top of Car Inspection Station.
6. Zoned Car Parking.
7. Relative System Response Dispatching.

C. Additional Operating Features Shall Include:

1. Independent Service.
2. Emergency Battery Power Supply: When the main line power is lost for longer than 5 seconds the emergency battery power supply provides power automatically to the elevator controller. The elevator will rise or lower to the first available landing, open the doors, and shut down. The elevator will return to service upon the return of normal main line power. An auxiliary contact on the main line disconnect and shunt trip breaker (if used) will be provided by others.

D. Elevator Control System for Inspections and Emergency:

1. Provide devices within controller to run the elevator in inspection operation.
2. Provide devices on car top to run the elevator in inspection operation.

3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.
4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted.
5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.
6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
7. Provide the means for the control to reset elevator earthquake operation

2.10 DOOR OPERATOR AND CONTROLS

A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

B. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.

E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.

B. Do not proceed with work until unsatisfactory conditions are corrected.

C. Prior to start of work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches. Do not begin work of this section until dimensions are within tolerances.

D. Prior to start of work, verify projections greater than two inches (four inches if ASME A17.1/CSA B44 2000 applies) must be beveled not less than 75 degrees from horizontal.

E. Prior to start of work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.

F. Prior to start of work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.

G. Prior to start of work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including sleeves and penetrations.

H. Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

3.2 PREPARATION

A. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

3.3 INSTALLATION

A. Install equipment, guides, controls, car and accessories in accordance with manufacturer installation methods and recommended practices.

B. Properly locate guide rails and related supports at locations in accordance with manufacturer's recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.

C. All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.

D. Lubricate operating system components in accordance with manufacturer recommendations.

E. Perform final adjustments, and necessary service prior to final acceptance.

3.4 CONSTRUCTION

A. Interface with Other Work:

1. Guide rail brackets attached to steel shall be installed prior to application of fireproofing.
2. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.
3. Ensure adequate support for entrance attachment points at all landings.
4. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.

5. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.
6. Coordinate interface of elevators and fire alarm system.
7. Coordinate interface of dedicated telephone line.

3.5 TSTING AND INSPECTION

A. Perform recommended and required testing in accordance with authority having jurisdiction.

B. Obtain required permits and provide originals to Owner's Representative.

3.6 DEMONSTRATION

A. Prior to final acceptance, instruct Owner's Representative on the proper function and required daily maintenance of elevators. Instruct personnel on emergency procedures.

END OF SECTION 142400

SECTION 149182 - TRASH CHUTES

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. Waste chutes.
2. Waste doors.
3. Diverters.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for metal supporting framework at floor penetrations.
2. Section 076200 "Sheet Metal Flashing and Trim" for roof-vent flashing.
3. Section 077200 "Roof Accessories" for prefabricated roof curbs.
4. Section 118226 “Facility Waste Compactors.”

1.3 DEFINITIONS

A. Chase: The shaft that encloses a chute.

B. Intake Door: Door or hatch that penetrates the chase wall and chute, and through which materials are fed into the chute.

C. Discharge Door: Door or hatch at the bottom of a chute, through which materials exit the chute.

D. Access Door: Door other than an intake or discharge door that penetrates the chase wall for service access to devices in the chase.

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 individual components and profiles, and finishes for chutes.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include each type and location of intake, discharge, and access door.
4. Include diagrams for power, signal and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fire-rated door inspector.

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. Coordination Drawings: Plan(s) 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. Size and construction of chase enclosing each chute; locations for power, signal, and control wiring; and sprinkler-piping and water-service connections.
2. Chute-discharge locations coordinated with compactor-intake or container locations.

C. Product Certificates: For each type of chute, from manufacturer.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For chutes to include in operation and maintenance manuals.

1.8 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] <Insert number> 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, plus the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Wilkinson Hi-Rise, LLC.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing and inspecting agency, for fire-protection ratings indicated.

1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.
2. Intake Doors: Labeled, 1-hour fire-resistance rated with 30-minute temperature rise of 250 deg F (140 deg C).
3. Access Doors: Labeled, 1-hour fire-resistance rated with 30-minute temperature rise of 250 deg F (140 deg C).

B. Discharge-Door Assemblies: Fire-resistive door construction according to NFPA 252 or UL 10B requirements for fire-rated door assemblies.

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. Standard: Provide chutes complying with NFPA 82 unless otherwise indicated.

2.3 WASTE CHUTES

A. Chute Metal: Aluminum-coated, cold-rolled, commercial steel sheet; ASTM A 463/A 463M, Type 1, with not less than T1-40 (T1M-120) coating.

1. Thickness: 0.060 inch.

B. Chute Size: 30-inch diameter.

C. External Reinforcing for Offsets: Additional thickness of 0.11-inch thick chute metal with bracing to structure.

2.4 WASTE DOORS

A. Intake-Door Assemblies: ASTM A 240/A 240M, Type 304, stainless-steel self-closing units with positive latch and latch handle, with stainless-steel trim; constructed as required for performance requirements indicated; and with frame suitable for the enclosing chase construction.

1. Door Type: Hopper.
2. Size: Manufacturer's standard size for door type, chute type, and diameter indicated.
3. Finish: Manufacturer's standard satin or No. 3 directional polish.

4. Lockset: T-handle-type cylinder lock that releases latch with key that is removable only when cylinder is locked.

    a. Lock Cylinder: Cylinders standard with manufacturer.
    b. Keying: For each chute, key cylinders alike.
    c. Keys: Three for each cylinder.

5. Latchset: T-handle type that unlatches door.
6. Accessible Automatic Door Operating System: Manufacturer's standard system complying with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.
7. Mechanical Interlocks: Interlock system for system servicing, operated from discharge door to automatically lock intake doors.
8. Electrical Interlocks: Interlock system that is energized by opening one intake door; remaining intake doors automatically lock when system is energized.
9. Baffles: Rubber backdraft baffles at each intake.

B. Discharge-Door Assemblies: Aluminum-coated steel. #16 gauge galvanneal or aluminized steel type “A” open end chute discharge rolling steel door with 165°F fusible link hold open on an inclined steel track at the bottom of the chute to close automatically when the ambient temperature reaches 165°F as required by city or state building and/or fire codes.

C. Detector System: Heat- and smoke-detecting interlock system with temperature-rise elements that locks chute doors when temperature in chute reaches a predetermined, adjustable temperature.

1. Locate smoke detector outside discharge door with solenoid to close discharge door.

D. Access-Door Assemblies: Manufacturer's standard ASTM A 240/A 240M, Type 302/304, stainless-steel doors with trim; constructed as required for performance requirements indicated; with frame suitable for the enclosing chase construction; and in satin or No. 3 directional polish finish; equipped with cylinder locks that release latch with keys that are removable only when cylinder is locked.

1. Lock Cylinder: Cylinders standard with manufacturer.
2. Keying: Key access-door cylinders alike.
3. Keys: Three for each cylinder.

E. Manual Control System: Control system with manual switch that lock chute doors during shutdown hours and service operations.

2.5 DIVERTERS

A. Diverters: Manufacturer's standard motorized system for distributing materials from one chute into two containers in the discharge room as indicated on Drawings. Integrate diverter controls with controls at intake doors.

B. Construction: Welded steel-plate housing with powered, internal steel blade(s) to deflect materials from chute into appropriate containers.

C. Controls: Integrated, electronic master control unit in discharge room and electronic controls at each intake door, including self-diagnostic program for whole system.

D. Motor Characteristics: Size sufficient to operate diverter blades without exceeding nameplate rating or service factor; complying with NEMA MG 1 and the following:

1. Horsepower: Manufacturer's standard.
2. Volts: 115 V.
3. Phase: Single phase.
4. Hertz: 60.
5. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet above sea level.

E. Recycling Containers: Industry standard, 90-gal. containers for comingled recyclables and 2-cu. yd. containers for newspaper as recommended by diverter manufacturer for compatibility with diverter system.

2.6 ACCESSORIES

A. Chute Fire Sprinklers: NFPA 13; manufacturer's standard, recessed, automatic, NPS 1/2 (DN 13) sprinklers; ready for piping connections.

B. Flushing Spray Unit: NPS 3/4 (DN 19) spray-head unit located in chute above highest intake door, ready for hot-water piping connection, and with access door for spray-head and piping maintenance.

C. Sanitizing Unit: NPS 3/4 (DN 19) disinfecting and sanitizing spray-head unit located in chute above highest intake door, including 1-gal. tank and adjustable proportioning valve with bypass for manual control of sanitizing and flushing operation, ready for hot-water piping connection, and with access door for spray-head and piping maintenance.

D. Intake-Door Baffles: Rubber baffles, 1/8 inch thick.

E. Sound Dampening: Manufacturer's standard, Daubert 932 sound coat vibration dampening compound to the exterior of the chute only. Include Korfund sound isolator pads at each floor support frame.

F. Spray Heads: 3/4 inch IPS flushing spray head and 1/2 inch sprinkler head above highest intake. Additional 1/2-inch sprinkler heads at every second intake (counting from the top) or as required by local code.

G. Vent: Chute shall extend full diameter through roof to metal top cap 4’-0” above roof level with counter flashing and insect screen. A roof curb (44”x 44” x minimum of 8” high) is required for flat roof conditions and is to be provided by others.

2.7 FABRICATION

A. General: Factory-assemble chutes to greatest extent practicable with nonleaking, continuously welded or lock-seamed joints without bolts, rivets, or clips projecting into chute interior. Include intake-door assemblies, metal supporting framing at each floor, and chute expansion joints between each support point.

B. Offsets: Construct offsets where indicated on Drawings. Fabricate so that installed chute is without obstructions that might prevent materials from free falling within chute.

1. Offsets below Intake Doors: Unless otherwise indicated, do not exceed a 15 degree maximum offset angle at any point, or place offset closer than 48 inches to nearest door above offset.
2. Offset above Top Intake Door: Do not exceed a 45 degree maximum offset angle between the highest intake door and the upper termination of chute.
3. Offsets at Floors: Complete offset between floors by returning chute to plumb before penetrating floors.
4. External Reinforcing: Externally reinforce impact area of offsets located below top intake door. Install vibration isolators where braced to structure.

C. Roof Vent: Fabricate vent unit as full-size extension of chute, open to the atmosphere. Extend vent to height above roofing surface as indicated on Drawings. Equip vent with full insect screening and metal explosion-release cap. Fabricate with roof-deck flange, counterflashing, and clamping ring of nonferrous metal compatible with chute metal.

D. Chute Fire Sprinklers: Install internally within chute, recessed out of the chute area through which material travels, and according to NFPA 13. Locate fire sprinklers at or above the top service opening of chutes, within the chute at alternate floor levels in buildings more than two stories tall, and at the lowest service level.

E. Equipment Access: Fabricate chutes with access for maintaining equipment located within the chute, such as flushing and sanitizing units, fire sprinklers, and plumbing and electrical connections.

PART 3 - EXECUTION

3.1 INSTALLATION OF WASTE CHUTES

A. Install and test chutes before installing enclosing chase construction.

B. Install chutes and diverters according to NFPA 82 and manufacturer's written instructions. Assemble components with tight, nonleaking joints. Anchor chutes securely to supporting structure to withstand impacts and stresses. Install chute and components to maintain fire-resistive performance of chute and the enclosing chase construction.

C. Install chutes plumb, without obstructions that might prevent materials from free falling within chutes.

D. Anchor flanges of chute vents to roof curbs before installing roofing and flashing. Install chute-vent counterflashing after roofing and roof-penetration flashing are installed.

3.2 INSTALLATION OF WASTE DOORS

A. Intake and Discharge Doors: Interface door units with throat sections of chutes for safe, snag-resistant, sanitary depositing of materials in chutes.

1. Coordinate installation of foot-pedal door operator with installation of door and the enclosing chase construction.
2. Interconnect sanitizer control with door interlock system.

B. Electrical Interlock System: Install according to applicable NECA 1 recommendations.

3.3 FIELD QUALITY CONTROL

A. Test chute components after installation.

1. Operate doors, locks, and interlock systems to demonstrate that hardware operates properly and smoothly and electrical wiring is connected correctly.
2. Complete test operations before installing chase enclosures.

B. Test heat- and smoke-sensing devices for proper operation.

C. Inspections:

1. Fire-rated door inspections: Inspect each fire-rated door according to NFPA 80, section 5.2
2. Repair or remove and replace door installations where inspections indicate that they do not comply with specified requirements.
3. Reinspect repaired or replaced doors to determine if replaced or repaired door installations comply with specified requirements.
4. Prepare and submit separate inspection report for each fire-rated door indicating compliance with each item listed in NFPA 80 and NFPA 101.

D. Plumbing Access Doors: After construction of chase enclosure, verify that access doors have been correctly located and properly installed for their purpose.

3.4 ADJUSTING

A. Adjust doors for smooth and balanced movement.

B. Operate sanitizing unit through one complete cycle of chute use and cleanup and replenish chemicals or cleaning fluids in unit containers.

3.5 CLEANING

A. After completing chase enclosure, clean exposed surfaces of chute system's components. Do not remove labels of testing and inspecting agencies.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain each chute and related equipment.

B. Demonstrate replenishment of sanitizing-unit chemicals or cleaning fluids.

3.7 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of chute Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper chute and diverter 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.

END OF SECTION 149182

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 21 Specifications, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

B. Description of Work:

1. Extent of the work is indicated on the Drawings and Schedules and by the requirements of this Section.
2. The construction requirements herein shall include appurtenant structures and buildings to which the system is to be installed.

1.3 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 300 psig.

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 DESIGN CRITERIA

A. Gridded sprinkler systems may be used on wet pipe systems where they are practical.

B. Provide fire protection products which are Factory Mutual or UL Listed.

C. Comply with local Fire Department regulations for sizes, hose threads and arrangement of connections for fire department equipment to fire department valves, and fire department connections.

D. All areas of the building, except as noted, shall be completely sprinklered including the following areas:

1. Electrical Rooms that are not enclosed within two-hour walls
2. Elevator Shafts.
3. Telephone Rooms.
4. Stairwells (at top level and below lowest level).

1.5 DESCRIPTION AND REQUIREMENTS

A. The work under this section of the specifications includes labor, materials, supervision and testing of the automatic sprinkler and associated systems.

B. The automatic sprinkler and associated systems shall be complete with all component equipment and material items and installed and tested in full conformity with the requirements of all applicable codes, National Fire Protection Associations Standards, authorities having jurisdiction and the Owner's insurance company.

C. Provide chrome metal wall plates and/or escutcheons on all exposed piping which penetrates walls, floors, etc. Plastic wall plates are not acceptable.

D. The installed layout of the sprinkler system shall be coordinated to avoid interference with the structural, electrical, mechanical, and plumbing work in the building.

E. Sprinklers shall be located as required to provide coverage as required by applicable standards and the Contract Documents.

F. Sprinklers shall be located to avoid interference with lights, diffusers, grilles, or other ceiling mounted equipment. Sprinklers located in ceiling tile shall not be closer than 12 inches to "T" bars and centered. The sprinkler layout shall conform to the typical pattern.

G. Provide vane-type electric flow switch on each riser. Also provide tamper switches on all control valves to be interfaced with fire control panel. Wiring shall be by characteristics of each switch necessary for compatibility with the fire alarm control panel.

H. Locate all inspector tests and drain lines in mechanical room and “back-of-house” type spaces. Main drains and auxiliary drains are to be extended through the nearest exterior wall.

I. Provide backflow prevention. Backflow preventer OS&Y valves shall be equipped with tamper switches.

J. All piping in exposed structure areas shall be installed above the bottom chord of the bar joists.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Installing Contractor shall anticipate a minimum of 30 days turn-around for reviewing sprinkler shop drawings by Architect-Engineer and Owner's insurance company. Installing Contractor shall submit shop drawings for review on a timely schedule so as not to impact construction schedule. All submittals (except for insurance submittal) for shop drawing review must be submitted directly to Architect. No submittals shall be made direct to Engineers. Submittals shall be made in one submission only; no partial submittals will be accepted. Partial submittals will be held until all components are received and may delay shop drawing review.

1.7 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. Compressed air piping.
3. HVAC hydronic piping.
4. Items penetrating finished ceiling include (but not limited to) the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.

5. HVAC equipment and ductwork.

B. Qualification Data: For qualified Installer (Engineer of Record).

C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Fire-hydrant flow test report.

F. 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."

G. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

B. Provide as-built drawings to the General Contractor to be turned over to the Owner at the completion of the project.

1.9 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. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.10 QUALITY ASSURANCE

A. All materials and equipment shall comply with requirements as specified in this section of these specifications.

B. All materials and equipment furnished and installed under this section of these specifications shall be new and in first class condition.

C. All materials and equipment furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor’s expense.

D. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

E. Manufacturing firms shall be regularly engaged in the manufacture of fire protection products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

F. Installation Firms shall have at least five (5) years of successful installation experience on projects with fire protection work similar to that required for the project.

G. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

H. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.11 FLOW TEST

A. Flow test data may be provided as part of the contract documents and may be used as a preliminary indicator of available water supply only. Flow test data may also be available from the local water supplier and should also be considered only as preliminary.

B. Each contractor submitting a bid on this project shall verify flow test information in the vicinity of the project by his own water flow test at the indicated hydrants. No requests for change orders will be accepted because successful contractor did not verify water supply information obtained from local authorities or did not run his own test prior to submitting his bid.

C. All flow test data shall be subject to the "10% rule" as defined in this paragraph. Before any calculations or supply curve plotting, reduce the reported static and residual pressures by 10%. Make no reduction to the flow rate reported.

D. Provide a reserve supply of sprinklers as required by NFPA 13 current edition. The sprinklers and tools shall be contained in a metal carrying case.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to job site in new and in first class condition.

B. Store materials and equipment utilizing suitable means so as to protect from weather, construction work traffic and contamination. Where materials and equipment are stored outdoors, Contractor shall cover in a suitable manner to prevent contamination from water, dirt, mud and/or debris. Materials and equipment shall not be laid on grade for storage.

C. Materials and equipment found to be contaminated with water, dirt, mud and/or other debris shall be cleaned and restored to new condition to the satisfaction of the Architect. Contaminated materials and equipment shall not be used until inspected. Materials and equipment determined to be unsuitable for use by the Architect shall not be used and shall be removed from the job site at the Contractor’s expense.

D. Provide a reserve supply of sprinklers as required by NFPA 13 current edition. The sprinklers and tools shall be contained in a metal carrying case.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide sizes and types of materials to match piping and equipment connections; provide fittings of materials which match piping materials used in fire protection systems.

B. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.
2. NFPA 13R.

C. Delegated Design: Engage a qualified professional engineer to design wet-pipe sprinkler systems.

1. Sprinkler system design shall be approved by authorities having jurisdiction.

a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
b. Sprinkler Occupancy Hazard Classifications:

1) Automobile Parking Areas: Ordinary Hazard, Group 1
2) Building Service Areas: Ordinary Hazard, Group 1
3) Churches: Light Hazard
4) Electrical Equipment Rooms: Ordinary Hazard, Group 1
5) Dry Cleaners: Ordinary Hazard, Group 2
6) General Storage Areas: Ordinary Hazard, Group 1
7) Laundries: Ordinary Hazard, Group 1
8) Libraries except Stack Areas: Light Hazard
9) Library Stack Areas: Ordinary Hazard, Group 2
10) Machine Shops: Ordinary Hazard, Group 2
11) Mechanical Equipment Rooms: Ordinary Hazard, Group 1
12) Office and Public Areas: Light Hazard
13) Plastics Processing Areas: Extra Hazard, Group 2
14) Printing Plants: Extra Hazard, Group 1
15) Repair Garages: Ordinary Hazard, Group 2
16) Residential Living Areas: Light Hazard
17) Restaurant Service Areas: Ordinary Hazard, Group 1
18) Solvent Cleaning Areas: Extra Hazard, Group 2
19) Upholstering Plants: Extra Hazard, Group 1

2. Minimum Density for Automatic-Sprinkler Piping Design:

a. Residential (Dwelling) Occupancy: 0.05 gpm over 400-sq. ft. area.
b. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
c. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft area.
d. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
e. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. area.
f. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. area.
g. Special Occupancy Hazard: As determined by authorities having jurisdiction.

3. Maximum Protection Area per Sprinkler: According to UL listing.

D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13. If piping is installed on moveable structure, installation shall comply with seismic requirements of NFPA 13.

2.2 PIPE

A. Above Ground Piping

1. All piping shall be new, designed for appropriate working pressure conforming to ASTM specifications and approved for fire sprinkler specifications.
2. All pipe shall be black steel unless galvanized is indicated for particular pipe sections on the drawings.
3. Schedule 40 piping may be used for piping 2" and smaller and may be joined by threading, roll grooving, or welding.
4. Schedule 10 piping may be used in all sizes and may be joined by roll grooving or welding only.
5. CPVC may be used in accordance with NFPA and the product listings.

B. Fittings:

1. Screwed fittings shall be standard approved, Class 250, cast iron or Class 150 malleable iron.
2. Flanged fittings shall be approved, short body, Class 250, black cast iron. Gaskets shall be full face, 1/8" minimum thickness red rubber.
3. All welded fittings shall be of the approved type and all welding according to NFPA requirements. No field welding will be permitted.
4. Mechanical couplings shall be approved for grooved end connections equivalent to Victaulic Style 75. All grooved couplings and fittings used throughout this project shall be from the same manufacturer. Grooved couplings and fittings shall be Grinnell Gruvlok, Gustin Bacon, or Victaulic.
5. Slip on fittings shall not be used. "Victaulic Fit" and "Victaulic Pressfit" and similar products are forbidden on this basis.
6. All inspector tests, drains and drum drips shall be Schedule 40 threaded.
7. Strap on tees or outlets may not be used. "Victaulic Snap-Let" or similar products and "Victaulic Style 921" or similar products are forbidden on this basis.
8. "Victaulic Style 920" mechanical tee or cross or similar products may be used.
9. CPVC fittings may be used in accordance with NFPA and the product listings.

C. Underground Piping:

1. Underground pipe shall be cement lined cast iron and/or ductile iron, Class 52 and/or PVC, C 900, Class 150 or Class 200. Fittings shall be Class 250 and installed in strict accordance with NFPA 24. All bends shall be rodded and thrust blocked.
2. All lead-in to sprinkler risers shall be ductile iron, Class 52, not less than 5' outside of the building. Flange and spigot shall be ductile iron, fittings to be Class 250 with retainer gland, rodded and thrust blocked.
3. Pipe passing under building grade beams shall have a 6" minimum clearance to prevent possible damage from building settlement.
4. All underground piping shall be flushed in accordance with NFPA #24.
5. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 JOINTS

A. Threaded joints shall be made up with piping compound or teflon tape applied to the male threads only.

B. Welded joints shall be done by qualified welders per the requirements of Division 23.

C. Flanged joints shall be made up with rubber gaskets and assembled with machine bolts with hexagon heads made of open hearth steel.

D. Soldered joints shall be made using suitable flux and solder as specified.

2.4 BASIC HANGERS AND SUPPORTS

A. Refer to Division 23, Pipe Hangers, Supports, and Anchor.

B. Supports shall comply with provisions of NFPA 13 except where superseded by these herein or noted in Division 23 specifications.

2.5 VALVES

A. Valves as indicated shall be provided by Milwaukee, Nibco, Victaulic, Grinnell or Mueller.

B. All valves shall be designed and manufactured with back seating features to allow them to be repacked under pressure when in the fully opened position.

C. Provide valves of one manufacturer wherever practical to achieve maximum possible uniformity and facilitate maintenance.

D. All valves must be listed for use in sprinklers systems in the latest edition of Factory Mutual Approval Guide and U.L. listed.

1. Gate valves 2" and smaller shall be of Class 250, with body and bonnet, cast bronze composition, threaded ends, OS&Y, solid disc.
2. Gate valves 2-1/2" and larger shall be rated 250 psi WWP, iron body, bronze mounted, with body and bonnet, Class B cast iron, OS&Y, flanged or threaded end.
3. Ball valves 2" and smaller shall be constructed of commercial brass rod, with Teflon seats, blowout proof stem.
4. Butterfly valves 4" through 12" may be substituted for gate valves, where appropriate. Valves shall be rated for 250 PSIG working pressures. Valve bodies may be ductile iron or aluminum bronze and wafer or lug style.
5. Check valves 2-1/2" - 12" shall be rated 250 PSI WWP, iron body, bronze mounted, OS&Y flanged end.
6. Pressure ratings of valves shall be as required to meet the pressure conditions to which they are likely to be exposed or the ratings listed above, whichever is greater.

2.6 SPRINKLER PIPING SPECIALTIES

A. Waterflow Indicator:

1. Waterflow indicator shall be vane type with adjustable retard and two sets of single pole, double throw contacts for A.C. or D.C. operation..

B. O.S.&Y. Valve Supervisory Switch:

1. Valve supervisory switch for O.S. & Y. gate valves shall be provided with tamperproof cover and two sets of single pole, double throw contacts for A.C. or D.C. operation, bracket and J-bolts. Unit shall be U.L. Listed and F.M. Approved..

2.7 SPRINKLERS

A. 1/2" brass pendent sprinkler, ordinary temperature, with concealing bracket and cover assembly. Cover shall be factory painted in a color selected by the Architect to match finish of ceiling in which it is installed, for use in high finish areas.

B. 1/2" chrome pendent sprinkler, ordinary temperature, with chrome plated, semi-recessed escutcheon, for use in all lay-in tile ceilings.

C. 1/2" brass upright sprinkler, ordinary temperature, for use in areas without ceilings.

D. 1/2" sidewall sprinklers as required in units.

E. 1/2" brass upright sprinkler, intermediate temperature, for use in areas above high ceiling space and electrical rooms.

F. Acceptable sprinkler manufacturers are: Viking, Tyco, and Victaulic.

2.8 FIRE DEPARTMENT CONNECTIONS

A. Fire department connection shall be two-way 4" x 2½" wall mounted type with drop clappers. Unit shall be complete with inlets with caps, chains and cast brass body. All exposed surfaces shall be polished chrome plate. Fire department connection shall be labeled with the name of the fire protection system served. The connection to the fire department shall be provided with an automatic ball drip with discharge drain line. The exact location shall be coordinated with the Fire Marshal prior to submission of the sprinkler shop drawings. Any adjustments in pipe routing shall to the Fire Dept. connection shall be included in the contractor's scope of work at no additional cost to the Owner.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall not fabricate and/or install fire sprinkler systems until Architect/Engineer has reviewed shop drawings / submittals for compliance with engineer design concept.

B. Any fire sprinkler systems fabricated and/or installed prior to the Architect/Engineer's review found to be in non-compliance shall be removed or corrected as per instructions from Architect/Engineer at Contractor's expense.

3.2 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.3 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.4 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.5 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

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.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. 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.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

M. 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 are not subject to freezing.

N. Pressurize and check preaction sprinkler system piping and air compressors.

O. Fill sprinkler system piping with water.

P. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Section 210533 "Heat Tracing for Fire-Suppression Piping."

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.

3.6 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. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. 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.

K. Steel-Piping, Cut-Grooved Joints: Cut square-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 joints.

L. 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.

M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

N. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

O. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

P. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.

Q. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

R. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

S. Plastic-Piping, Solvent-Cement 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. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3.7 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13 or NFPA 13R for supports.

3.8 VALVE AND SPECIALTIES INSTALLATION

A. Provide gate, globe and check valves throughout systems where shown and where necessary to properly regulate and control the systems. Valves shall be the full size of the lines and shall be designed for low pressure drop. Gate and globe valves shall have provision for repacking when open and under pressure.

B. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

C. 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.

D. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

E. Automatic air vents shall be installed with gate valves.

F. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system. Valves in horizontal piping shall be installed with stems at or above the pipe centerline
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.9 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension 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.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

D. Install dry barrel head type sprinklers for all main entry vestibules and balconies.

E. Provide basket type guards over all upright sprinklers.

F. Sprinklers shall be provided above and below all ductwork or other obstructions greater than 4'-0" in width.

G. Sprinklers shall be centered in 2 x 2 ceiling tiles and at least 12” from each of 2 x 4 ceiling tiles.

H. Provide shields on all sprinklers located near electric panels to limit the sprinkler discharge on the panels.

I. Install sprinklers so that heads are located no closer than 1'-0" to lights, diffusers, or other obstructions.

J. Where sprinklers are exposed to exterior sprinklers must be wax coated to protect exposed surfaces from corrosion.

K. Provide UL listed flexible expansion fittings where piping crosses building expansion joints.

3.10 INSTALLATION

A. The fire protection system shall include all signs, test connections, and drains required by NFPA 13.

B. Comply with requirements of NFPA 13 for installation of fire protection piping materials. Install piping products where indicated, in accordance with manufacturer's written instructions.

C. Coordinate with other work, including plumbing piping, as necessary to interface components of fire protection piping properly with other work.

D. Fire mains, crossmains, and branch piping shall not be installed inside or above the ceiling of Electrical Equipment Rooms, Telephone Rooms, Elevator Equipment Rooms, or other rooms of similar usage. Only sprinkler branch piping which serves sprinklers located inside such rooms shall be permitted to be installed within room.

E. Automatic sprinklers protecting elevator shafts shall have a supervised control valve located in an accessible location outside of the room, so that sprinkler heads in these areas may be shut down separately.

F. All valves in direct flow of water to sprinklers, standpipes or exterior connections shall be provided with valve position supervisory switches.

G. Waterflow indicators shall be mounted horizontally or vertically on top of pipe. Adjust retard to provide maximum of 30 second delay. Schedule 40 pipe must be provided for waterflow indicator.

H. O.S. & Y. valve stem shall be carefully filed to accommodate stem of valve switch.

3.11 DRAINS

A. All trapped sprinkler piping shall be provided with drain valves and shall be routed to and discharged over the nearest suitable floor drain, hub drain or service sink. Drain valve shall be located at the point of discharge.

B. All drains and inspector's test connections located on exterior walls shall be painted to match exterior and penetration shall be sealed and provided with chrome plated escutcheon secured to wall.

3.12 ANCHORAGES

A. General: Provide concrete thrust block anchorages for underground tees, plugs, caps, and bends in accordance with NFPA 24. Provide rods and clamps on fittings located underground inside building as shown on drawings.

B. After installation, apply a full coat of asphalt or other acceptable corrosion retarding material to surfaces of rods and clamps.

3.13 IDENTIFICATION

A. Install signs on all inspector's test connections, auxiliary drains, drain valves, etc., in accordance with NFPA 13.

B. Access panels provided for valves concealed above ceilings or inside partitions must be provided with permanently attached signs identifying control valve or drain.

3.14 ADJUST AND CLEAN:

A. Sprinkler Piping Flushing: Prior to connecting sprinkler risers for flushing, flush water feed mains, lead in connections and control portions of sprinkler piping. After fire sprinkler piping installation has been completed and before piping is placed in service, flush entire sprinkler system as required to remove foreign substances, under pressure as specified by NFPA 13, current edition. Continue flushing until water is clear, and check to ensure that debris has not clogged sprinklers.

3.15 TESTING

A. Hydrostatic Testing: After flushing system, test fire sprinkler piping hydrostatically, for a period of 2 hours, as follows:

1. 150 psi or less, test pressure 200 psi.
2. 151 psi or more, test pressure 50 psi above normal operating pressure.

B. Check system for leakage at joints. Measure hydrostatic pressure at low point of each system or zone being tested. No drop in pressure is permitted.

3.16 PAINTING:

A. Painting of properly prepared sprinkler piping and equipment shall be by the Contractor.

B. The Contractor is to remove all labels, stickers, fabrication identification tags, excess pipe dope and teflon tape from sprinkler piping before system is painted.

C. The Contractor is to install protective plastic bags on all sprinkler heads in areas where roof deck and/or structural system is to be painted.

D. The Contractor will remove all plastic bags after the final painting is complete.

E. The Contractor shall furnish a signed statement on his letterhead and place it in the operating instruction and maintenance manuals that he has verified that all plastic bags have been removed.

F. Any sprinkler head not protected from painting and subsequently receiving paint coating shall be replaced. Cleaning of sprinkler heads to remove paint is not acceptable.

3.17 WARRANTY

A. Provide a written warranty in accordance with the general conditions.

B. This warranty shall further provide that in the event of the failure of any system or its component equipment items or the improper functioning thereof, during the period of the warranty, the contractor shall have available and "on call" competent service personnel for the restoration of all systems and equipment for complete operation. Should the nature of the failure be such as to present an emergency in the opinion of the Owner, such personnel shall be promptly available regardless of the hour of the day or the day of the week. Should the failure be such as to fall under the warranty, the cost of the service shall be borne by the contractor -otherwise, the Owner will pay therefore at the prevailing rate for such services.

C. If service personnel of the installing contractor are not promptly available "on call," the Owner may employ such personnel as are available to him, at the expense of the installing contractor.

D. Inspection and Tests

1. All inspections, examinations and tests required by NFPA, local authority having jurisdiction, and Owner's insurance company shall be arranged as necessary to obtain complete and final acceptance of the sprinkler system. The Contractor shall deliver certificates of all inspections and tests to Architect.
2. At job conclusion the entire system shall be flushed out and left clean in every respect.
3. After systems have been installed, tested and accepted, contractor is to provide three (3) copies of operating instructions and maintenance manuals complete with a copy of approved shop drawings, copy of NFPA-25, spare parts lists and phone numbers of emergency repair personnel to Architect. A copy of hydraulic calculation nameplate as installed on each riser shall be included in O & M manuals.
4. Provide three (3) copies of underground material and test certificate.

3.18 QUARTERLY INSPECTIONS:

A. Installing Sprinkler Contractor is to provide a minimum of four (4) on-site sprinkler system inspections during the one (1) year warranty period.

1. Inspections to consist of all items outlined in NFPA-25 such as lubricating valve stem of valves, replacement of F.D.C. (fire department connection) break-off caps if missing, etc.
2. After each quarterly inspection, copies of inspection reports outlining results and listing any problems observed shall be forwarded to the Owner, Owner's insurance company, and Architect and Engineer of Record.

END OF SECTION 211313

SECTION 213113 – ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS

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.

B. All work specified in this section is subject to the provisions of "Mechanical General."

1.2 DESCRIPTION:

A. This section and related drawings describe the requirements for an electric motor drive fire pump, jockey pump, and all related piping accessories and controls.

1.3 QUALITY ASSURANCE:

A. Manufacturing firms shall be regularly engaged in the manufacture of fire pumps and equipment of the type and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. UL and NEMA Compliances - Provide electric motors and electrical components required as part of fire pump equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.

C. NEC Compliance - Comply with National Electrical Code (ANSI/NFPA 70) as applicable to installation an electrical connections of ancillary electrical components of fire pump equipment.

1.4 CODES AND STANDARDS:

A. Install fire pump and controllers in accordance with NFPA 20 "Centrifugal Fire Pumps."

1.5 SUBMITTALS:

A. Product Data - Submit manufacturer's fire pump equipment specifications, installation and start-up instructions, and capacity and ratings, with selection points clearly indicated.

B. Shop Drawings - Submit assembly type shop drawings indicating dimensions, weights, required clearances, and methods of assembly of all components.

C. Wiring Diagrams - Submit ladder type wiring diagrams for all components, clearly indicating all required field electrical connections.

D. Maintenance Data - Submit maintenance data and parts lists for each item of fire protection equipment. Include "trouble-shooting" maintenance guides. Include this data in maintenance manual.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Handle pumps and components carefully to prevent damage, breaking, denting and scoring. Do

not install damaged fire pumps or components; replace with new.

B. Store pumps and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with Manufacturer's rigging and installation instructions for unloading pumps, and moving them to final location.

PART 2 - PRODUCTS

2.1 FIRE PUMP:

A. The fire pump shall be designed to deliver the capacity as indicated on the drawings. If drawings do not indicate pump specification, selection shall be as required for hydraulic characteristics and compatible with electric service.

B. The pump shall deliver not less than 150% of the rated capacity at a pressure not less than 65% of the rated head. The shut-off pressure shall not exceed 120% of the rated pressure. Pump speed shall be selected by the manufacturer to meet the specified ratings.

C. The pump shall be horizontal split case, single stage, double suction type with bronze or stainless steel shaft sleeves.

D. The pump unit shall meet requirements of the NFPA 20 and shall be listed by Underwriter's Laboratories and approved by Factory Mutual at the design flow conditions.

E. The following accessories shall be included with the pump unit:

1. 1" casing relief valve set at 250 psig.
2. Compound suction gauge, -15 to 250 psi and 0 to 400 psi discharge gauge.
3. Automatic air release valve.
4. Discharge increaser, concentric type, 250 lb. flanges, if required.
5. Suction reducer, eccentric type, if required.
6. Coupling guard.

F. Pump and driver shall be mounted on a common base plate and direct connected through a flexible coupling. Pump suction and discharge shall be arranged to conform to piping arrangement shown on drawings.

G. The pump system shall be hydrostatically tested in the factory to twice the working pressure but in no case to less than 250 lbs. per square inch.

H. The fire pump unit shall be given a complete performance test by the manufacturer and certified characteristics curves prepared from the shop test results shall be bound in the Operations and Maintenance Manuals.

I. Driver for the fire pump shall be a standard NEMA design B, open drip proof, ball bearing, squirrel cage, induction type electric motor with 1.15 service factor. Locked motor current shall not exceed the values specified in NFPA 20. Coordinate electrical characteristics with electrical drawings and specifications. Horsepower rating shall be as required for FM approval and UL listing.

J. Provide a Fire Pump Suction Control valve equivalent to Watts ACV figure 116-1FM at the discharge of the fire pump if any of the following criteria are met:

1. drawings indicate such control valve.
2. calculations indicate the pump suction pressure is less than 20 psi at the greatest system demand.
3. the water supply is known to be variable or unreliable.

K. Fire pump shall be by AC Fire (Xylem), Fairbanks Morse, Peerless, Patterson, or Aurora.

2.2 FIRE PUMP CONTROLLER:

A. The fire pump controller shall be completely assembled, wired and tested at the factory and assembly shall be specifically approved for fire pump purposes. All equipment shall be enclosed in one or more UL approved NEMA 12 drip tight enclosures.

B. If the electrical drawings indicate, or the authority having jurisdiction requires, that the fire pump is to be connected to the emergency generator (or other alternate power source). In such case, the controller shall have a built in automatic transfer switch.

C. The controller shall be of the combined manual and automatic reduced voltage type incorporating the following:

1. Disconnect switch, externally operable, quickbreak type.
2. Motor starter and automatic transfer switch (if included) shall be capable of being energized automatically through the pressure switch or manually by means of an externally operable handle.
3. Starter shall be of the UL listed, solid state, soft start type with bypass.
4. Running period timer set to keep motor in operation, when started automatically, for a minimum period of one minute for each 10 HP motor rating but not to exceed 7 minutes.
5. Control power shall be supervised by starting the fire pump upon loss of control power.
6. Controller shall be service entrance rated.

D. The Solid State (soft start) Controller shall be Firetrol Series FTA1930 or equivalent.

2.3 JOCKEY PUMP:

A. The jockey pump shall be supplied by the fire pump manufacturer and shall be a bronze fitted centrifugal vertical, multi-stage or a peripheral turbine type with casing arranged so that pump is self venting and cannot be air or vapor locked; pump shall have mechanical seal and stainless steel shaft; casing pressure rating shall be at least 50 psi higher than the specified discharge pressure at the fire pump.

B. Pump shall be closed coupled to a 3500 RPM, open drip proof electric motor. Coordinate electrical connections with electrical drawings. Pump shall have a minimum capacity as noted on drawings.

C. Set the pressure switch for a 10 psig differential with the cut-in-point 10 psig above the cut-in point of the fire pump control.

D. Provide in the pump discharge a relief valve.

E. Furnish a spare mechanical shaft seal for the jockey pump.

F. Jockey pump shall be by Goulds or Grundfos.

2.4 JOCKEY PUMP CONTROLLER:

A. Provide a UL listed jockey pump controller consisting of an across the line magnetic starter with thermal overload relay, pressure switch, fused disconnect switch, and hand-off-automatic selector switch, 0-10 minute minimum run timer, all in NEMA 1A general purpose enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install the pumps and accessories in accordance with the manufacturer's recommendations and the requirements of Section 23 00 01 "Mechanical General."

B. Provide water pressure connection piping for the fire pump and jockey pump controls, pipe pump drip pockets to floor drain.

3.2 TESTING:

A. Fire pump and Controller shall be completely shop tested by the pump manufacturer before shipment and copies of certified test pump curves shall be delivered to the Engineer. Notify Architect/Engineer two weeks prior to testing so that he may send his representative to witness test if he so chooses. Confirm all tests in writing and submit two copies to Architect/Engineer.

B. Perform field acceptance tests of the pumps as required by NFPA 20 and the Authority having jurisdiction; coordinate the testing with tests of sprinkler system.

C. The pump manufacturer shall provide the services of a qualified service technician to conduct the final acceptance test of this pump and control equipment. Alignment shall be checked with a dial indicator. The pump representative shall furnish the necessary fire hose, play pipes, test gauges and other equipment necessary to conduct the acceptance test.

D. All tests shall be conducted in the presence of, and to the satisfaction of the authority having jurisdiction and the Engineer, each of whom shall be notified seven (7) days in advance of any such tests.

END OF SECTION 23 3113

SECTION 220500 – COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

1.1 DESCRIPTION:

A. Include all necessary apparatus, excavating, controls, valves, and fittings required for a complete plumbing system.

1.2 REFERENCES:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 21 Specifications, and Division 01 Specification Sections, apply to this Section.

B. Refer to Division 22000 for specifications for piping, insulation, general requirements.

1.3 UTILITIES AND SERVICES:

A. Sanitary: Provide sanitary drainage, connect to site utility building systems.

B. Water: Provide domestic (City) water, connecting to site water mains.

1.4 TESTS:

A. Test the plumbing system as required by the applicable plumbing code.

B. Test water piping for a continuous period of not less than four hours at a hydrostatic pressure of not less than one hundred twenty five (125) pounds and make free from leaks. Completely remake leaky joints with piping dry. Retest system after leaks are corrected.

C. Plug all necessary openings in the drainage and vent piping systems fill the entire system with water to the level of the highest vent stack above the roof. The system shall hold this water for 30 minutes without showing a drop in water level greater than 4 inches. Subject to approval of the Architect the drainage system may be tested in sections.

1.4 STERILIZATION:

A. Disinfect the potable water system in accordance with the Plumbing Code. After disinfection, send water samples to the Local Health Department for testing. Obtain approval of the Local Health Department before the system is placed into service.

B. Chlorination shall be done per manufacturer’s recommendations. Unless the Local Health Department and piping manufacturer requires otherwise, disinfect potable water piping upon completion of installation by a mixture containing not less than 0.6 pound of high test calcium hypochlorite, or 2 pounds of chlorinated lime to each 1000 gallons of water to provide not less than 50 ppm of available chlorine. Inject the mixture into the system and retain for not less than 24 hours, at which time the chlorine level shall be at 10 ppm or greater. Then drain the system and flush with potable water until only a normal chlorine residual remains (.2 ppm).

PART 2 MATERIALS

2.1 PLUMBING FIXTURES:

A. Comply with additional fixture requirements contained in fixture schedule.

B. Subject to compliance with requirements, see Architectural plans for fixture specifications.

2.2 PLUMBING FIXTURES:

A. Provide factory-fabricated fixtures of type, style and material indicated on drawings. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete installation. Where more than one type is indicated, selection is Installer's option; but, all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

B. Vitreous china fixture color shall be white unless noted otherwise.

C. Fixtures shall be as scheduled on the drawings and as noted on the plans.

2.3 MATERIALS:

A. Provide factory-fabricated fixtures of type, style and material indicated on drawings. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete installation. Where more than one type is indicated, selection is Installer's option; but, all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

B. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units shall not be acceptable.

C. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed. PVC traps and waste lines, Uponor stops and supplies are permitted under residential kitchen sinks and lavatories. Uponor stops and braided supplies are permitted at residential water closets.

2.4 PLUMBING FITTINGS, TRIM AND ACCESSORIES:

A. At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply.

B. Include removable P-traps where drains are indicated for direct connection to drainage system.

C. Provide fixture carriers or supports as required, constructed of cast-iron, steel, or combination of these materials as required for a complete and proper fixture installation.

D. Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

E. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.

F. Where fixture supplies and drains penetrate walls in exposed locations, provide chrome plated escutcheons.

G. Provide aerators on all faucet sets of types approved by Health Departments having jurisdiction.

H. Comply with additional fixture requirements contained in fixture schedule.

2.5 CLEANOUTS:

A. Cleanouts in cast iron soil pipe lines shall consist of cast iron ferrule and heavy brass cleanout plug with square head. Where piping is concealed in floors or walls, install cleanouts with counter sunk plugs and covers in and near surface of floors or walls.

B. Cleanouts for floors shall be Mifab series C1000-R with inside caulk outlet coated cast iron internal cleanout with lead seal, brass rim and Nikaloy cover plate for light traffic secured to plug by countersunk screw for installation flush with finished floor. For floors with VCT, provide cover plate with depression for inset of VCT. Provide carpet marker in carpeted areas. Cleanouts in walls, Mifab C1450-RD with stainless steel covers. Wall cleanouts in PVC may be PVC tee with PVC cleanout plug and chrome plated or paintable cleanout cover. Wall cleanouts in cast iron may be no-hub tee with brass or PVC cleanout plug and chrome plated or paintable cleanout cover.

C. Equal manufactured by Zurn Industries, Inc., Wade Manufacturing Company, Josam, or J.R. Smith.

2.6 FLOOR DRAINS:

A. Mifab, Josam Manufacturing Company; Zurn Industries, Inc., Wade Manufacturing Company, J.R. Smith.

B. Floor Drain (FD), as scheduled on plans, coated cast iron floor drain, two piece body with double drainage flange, flashing collar, weepholes, bottom outlet, inside caulk connection, adjustable satin nikaloy strainer and cast iron p trap. Strainer top shall be two sizes larger than drain size.

C. Floor drains shall be provided with a passive trap primer valve and line, connected to nearby sink. Trap guards can be utilized in lieu of trap primers if allowed by local jurisdiction having authority. Trap primers exposed on the wall of the space will not be acceptable. Residential shower drains shall be PVC with chrome plated strainer.

2.7 WATER HAMMER ARRESTORS:

A. Water hammer arrestors shall be selected and sized in strict accordance with Standard P.D.I. WH201.

B. Arrestors shall be piston type, Josam 75000 or equal Mifab, Zurn, Smith, Wade, Precision Plumbing Products.

2.8 DOMESTIC WATER SERVICE/WATER PRESSURE REDUCING VALVE:

A. Where pressure of water service exceeds 70 PSI, a water pressure reducing valve shall be provided. Water pressure reducing valve for building shall be high capacity regulator Watts Series 223-S rated 250 PSI inlet, set 65 PSI outlet. For sizes larger than 2-1/2", use multiple PRVs in parallel. In residential units, a Watts model 25AUB or equal may be provided and preset at 50 psi from the factory with one ball valve, no by-pass, no pressure gauges, and no extra isolation valves.

B. When a PRV is not required, incoming water service shall incorporate a strainer with a pressure gauge on each side. Watts 77 Series strainer.

2.9 HOSE BIBBS:

A. Interior hose bibbs (nonfreeze areas): Woodford, 1/2" chrome plated, all brass construction with adjustable packing nut, teflon impregnated packing and standard "O" size washer, tee handle, and vacuum breaker. Equal by Chicago Mfg., Mifab, or T & S Brass Co.

2.10 BACKFLOW PREVENTER:

A. Watts #909 water pressure backflow preventer of same size as pipe installed in. Complete with check valve, gate valves, and test cocks. Equal by Cla-Val or Cash Acme.

2.11 VACUUM BREAKERS AND CHECK VALVES:

A. Provide on connections to all hose bibbs, hose outlets, wall hydrants, below the rim water supplies of all types, plugged or capped outlets, and at all locations specified or shown. Vacuum breakers shall be Watts Regulator Company Model No. 288A or Sloan Valve Company Series V with bronze body chrome plated in finished areas.

PART 3 EXECUTION

3.1 GENERAL:

A. Make connections to all fixtures, traps and similar items. Place into operation all equipment.

B. Refer to architectural drawings for the exact location of fixtures and drains. Determine roughing dimensions from the manufacturer of the equipment furnished on the job.

3.2 PLUMBING FIXTURES:

A. Grout between plumbing fixtures and walls and/or floors.

B. Connection of fixture traps from lavatories, drinking fountains, service sinks, etc. to cast iron shall be made with D.W.V. type copper. Connections may also be made with PVC.

3.3 FLOOR DRAINS:

A. Set floor drains with top flush with finished floor. Route water line from trap primer connection to floor drain concealed inside walls, partitions, and the floor system.

3.4 CLEANOUTS:

A. Provide cleanouts where required by the applicable plumbing code. Do not locate clean-outs in finished floor areas without specific approval by the Architect. Cleanouts to be placed at 75 ft intervals on piping mains.

B. Cleanouts shall be the same size as pipe line in line sizes 4 inches and smaller. Pipe lines larger than 4 inches shall have 4 inch cleanouts.

C. Cleanouts installed outside buildings shall be same as in floors and shall be flush with grade and have minimum 6 inch thick, 12 inch by 12 inch concrete pad poured around Cover. Cover shall be flush with top of concrete.

3.5 PRESSURE REDUCING VALVES:

A. Provide for a pressure test of the water service. Where pressure exceeds 70 PSI, provide a pressure reducing station. Pressure reducing station shall include a pressure reducing valve, by-pass with globe valve, pressure gauges and isolation valves at entering and leaving sides. Where water service is 2” in size or larger, provide second parallel pressure regulator on pressure reducing station with the same appurtenances on that branch. Both pressure regulators are to be full size of incoming water service. In residential units, a Watts model 25AUB or equal may be provided and preset at 50 psi from the factory with one ball valve, no by-pass, no pressure gauges, and no extra isolation valves.

3.6 BACKFLOW PREVENTER:

A. Provide in incoming domestic water service where required by local codes or utility requirements.

B. Provide a full size copper drain line from unit to floor drain.

3.7 INSPECTION AND PREPARATION:

A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Comply with applicable requirements of the Plumbing Code pertaining to installation of plumbing fixtures.

C. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.

D. Where fixtures are floor mounted, mounted against or abut walls, or countertop mounted, caulk along fixture to provide watertight seal.

3.8 CLEAN AND PROTECT:

A. Clean plumbing fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during the remainder of the construction period.

3.9 FIELD QUALITY CONTROL:

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect. Remove cracked or dented units and replace with new units.

3.10 EXTRA STOCK:

A. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one (1) device for every forty (40) units, but in no case less than two (2) devices.

END OF SECTION 220500

SECTION 220533 - HEAT TRACING FOR PLUMBING 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 plumbing piping heat tracing for freeze prevention, domestic hot-water-temperature maintenance, and snow and ice melting on roofs and in gutters and downspouts with the following electric heating cables:

1. Plastic insulated, series resistance.
2. Self-regulating, parallel resistance.
3. Constant wattage.

B. Related Requirements:

1. Section 210533 "Heat Tracing for Fire-Suppression Piping."
2. Section 230533 "Heat Tracing for HVAC Piping."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
2. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

B. Shop Drawings: For electric heating cable.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

1. Warranty Period: [Three] [Five] <Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PLASTIC-INSULATED, SERIES-RESISTANCE HEATING CABLES

A. Chromalox CPR commercial self-regulating heat trace system or approved equal by Nelson or Thermon,

B. Comply with IEEE 515.1.

C. Heating Element: Single- or dual-stranded resistor wire. Terminate with waterproof, factory-assembled, nonheating leads with connectors at both ends.

D. Maximum Operating Temperature (Power On): 300 deg F.

E. Maximum Exposure Temperature (Power Off): 185 deg F.

F. 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.

G. Capacities and Characteristics:

1. Maximum Heat Output: 6 W/ft.
2. Electrical Characteristics for Single-Circuit Connection: 120V/1PH, 60Hz

2.2 CONTROLS

A. Pipe-Mounted Thermostats for Freeze Protection:

1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.
2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
4. Corrosion-resistant, waterproof control enclosure.

B. Precipitation and Temperature Sensor for Snow Melting on Roofs and in Gutters:

1. Microprocessor-based control with manual on, automatic, and standby/reset switch.
2. Precipitation and temperature sensors shall sense the surface conditions of roof and gutters and shall be programmed to energize the cable as follows:

    a. Temperature Span: 34 to 44 deg F.
    b. Adjustable Delay-Off Span: 30 to 90 minutes.
    c. Energize Cables: Following two-minute delay if ambient temperature is below set point and precipitation is detected.
    d. De-Energize Cables: On detection of a dry surface plus time delay.

3. Corrosion-proof and waterproof enclosure suitable for outdoor mounting, for controls and precipitation and temperature sensors.
4. Minimum 30-A contactor to energize cable or close other contactors.
5. Precipitation sensor shall be freestanding.
6. Provide relay with contacts to indicate operational status, on or off, for interface with central HVAC control-system workstation.

C. Programmable Timer for Domestic Hot-Water-Temperature Maintenance:

1. Microprocessor based.
2. Minimum of four separate schedules.
3. Minimum 24-hour battery carryover.
4. On-off-auto switch.
5. 365-day calendar with 20 programmable holidays.
6. Relays with contacts to indicate operational status, on or off, and for interface with central HVAC control-system workstation.

2.3 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Section 220553 "Identification for Plumbing Piping and Equipment."

C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written instructions; use cable-protection conduit and slack cable to allow movement without damage to cable.

B. Electric Heating-Cable Installation for Snow and Ice Melting on Roofs and in Gutters and Downspouts: Install on roof and in gutters and downspouts with clips furnished by manufacturer that are compatible with roof, gutters, and downspouts.

C. Electric Heating-Cable Installation for Freeze Protection for Piping:

1. Install electric heating cables after piping has been tested and before insulation is installed.
2. Install electric heating cables according to IEEE 515.1.
3. Install insulation over piping with electric cables according to Section 220719 "Plumbing Piping Insulation."
4. Install warning tape on piping insulation where piping is equipped with electric heating cables.

D. Electric Heating-Cable Installation for Temperature Maintenance for Domestic Hot Water:

1. Install electric heating cables after piping has been tested and before insulation is installed.
2. Install insulation over piping with electric heating cables according to Section 220719 "Plumbing Piping Insulation."
3. Install warning tape on piping insulation where piping is equipped with electric heating cables.

E. Set field-adjustable switches and circuit-breaker trip ranges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections **with the assistance of a factory-authorized service representative**:

1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
2. Test cables for electrical continuity and insulation integrity before energizing.
3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

D. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.

E. Cables will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 PROTECTION

A. Protect installed heating cables, including nonheating leads, from damage during construction.

B. Remove and replace damaged heat-tracing cables.

END OF SECTION 220533

SECTION 220719 – PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Provide insulation for equipment, piping and ductwork furnished under this division.

B. HVAC piping (refrigerant, condensate, heating hot water, chilled water, and condenser water piping) shall be insulated. See HVAC section 230719 “HVAC piping insulation” for additional information.

C. Piping not to be insulated:

1. Chromium plated brass connections to plumbing fixtures.

2. Underground domestic cold-water piping.

1.2 QUALITY ASSURANCE:

A. Products of the manufacturers listed under PRODUCTS will be acceptable for use for the specific functions noted. Adhesives, sealers, vapor barriers and coatings shall be compatible with the materials to which they are applied, and shall not corrode, soften or otherwise attack such material in either the wet or dry state.

B. Material shall be applied subject to their temperature limits. Application of insulating materials or finishes shall be in accordance with manufacturer's published recommendations unless otherwise specified herein.

C. Insulation shall be applied by experienced workers regularly employed for this type of work.

1.3 RATING:

A. Insulation and accessories such as adhesives, mastics, cements, tape and jackets, unless specifically excepted, shall have a flame spread rating of not more than 25 and a smoke developed rating of not more than 50. Materials which are field applied may be tested individually.

B. Flame Spread and Smoke Developed Ratings shall be determined by Method of Test of Surface Burning Characteristics of Building Materials, NFPA No. 255, ASTM E 84, UL 723.

C. Products or their shipping cartons shall bear a label indicating the flame and smoke rating do not exceed above requirements.

D. Treatment of jackets or facings to impart flame and smoke safety shall be permanent. Water soluble, fugitive, or corrosive treatments shall not be used to meet RATINGS criteria.

E. Certify in writing prior to installation, that products to be used will meet RATING criteria.

F. The perm rating for vapor barriers shall be not more than 0.05 perms and the rating for adhesives, coatings and mastics shall be not more than 0.25 perms.

1.4 SHIELDS:

A. Pipe covering protection shields shall be provided around exterior of pipe insulation at pipe hangers which fit around pipe insulation.

B. Shields are not required on PEX piping. PEX piping shall be supported with PEX hangers that support piper in order to keep it from moving. Insulation shall be wrapped around these supports.

PART 2 - PRODUCTS

2.1 FIBERGLASS PIPE INSULATION:

A. Insulate:

1. Domestic hot water and hot water return piping.

2. Above ground horizontal waste piping receiving waste from electric water coolers, from drinking fountain tailpiece outlet to connection at waste stack.

3. Vertical condensate risers shall be CPVC and will not be insulated. Horizontal condensate piping above finished ceilings shall be provided insulation.

B. Pipe insulation thickness shall be as follows:

Service	**Pipe Size**	**Insulation Thickness**
Dom. Hot Water	Below 1-1/2”	1”
	1-1/2” and Above	1-1/2”
Condensate Drains	All Sizes	1”

C. Insulation: one piece fibrous glass sectional pipe insulation with factory applied glass reinforced aluminum foil and white kraft paper flame retardant vapor barrier jacket, with self-sealing longitudinal jacket laps and butt strips; average thermal conductivity not to exceed 0.23 BTU in./ft.2 - oF. - hour at a mean temperature of 75°F.

D. Insulation shall be:

Johns Manville	Micro-Lok AP-T
Owens Corning	Fiberglass 25 ASJ/SSL

E. Insulating cement shall be:

Johns Manville	No. 301
48 Insulations	Quik Set
Rockwood Mfg. Co.	Delta Maid One Shot

F. Vapor barrier coating shall be:

Benjamin Foster	Tite Fit 30 35
Vimasco	740
Insul Coustic	F.R.V.B. IC 501
Childers Cil Perm	CP 30

G. Breather coating shall be:

Benjamin	Sealfas 30 36
Insul Coustic	Permsure IC 102
Vimasco	713
Childers Chil Seal	CP 50
Equal by Knauf.	

2.2 CLOSED-CELL FOAM INSULATION:

A. All domestic cold water piping shall be insulated with preformed flexible closed cell elastomeric foam piping insulation system permeated with an anti-microbial agent, with a maximum thermal conductivity (k) of 0.25, butt joints and self-adhesive longitudinal seams with self-adhesive lap strip, AP Armaflex Black Lap Seal with Microban. Seal all seams with self-sealing adhesive lap strips; seal all joints between sections with Armaflex 520 solvent adhesive and tape. Fittings shall be fabricated from mitred sections of preformed pipe, tape and/or solvent seal all seams and joints. Provide Armafix IPH inserts or Foam-Glas inserts at hangers. Insulation thickness shall be 1" for all dom. cold water pipe diameters.

B. HVAC piping (refrigerant, condensate, heating hot water, chilled water, and condenser water piping) shall be insulated. See HVAC section 230719 “HVAC piping insulation” for additional information.

2.3 PREMOLDED LAVATORY INSULATION:

A. Insulate all piping below handicap accessible sinks per ADA requirements. Insulate P-traps, trap arm, angle stop valves, and risers with a packaged molded vinyl insulation kit, Handi Lav-Guard model 102W and 105W by Truebro, or approved equivalent. Provide factory preformed piping insulation kits as described or approved equivalent only. Other types of insulation systems: non-molded vinyl covered cloth with velcro or zip-up covers, field fabricated pipe insulation systems, and flexible strip wrapping type insulation are not acceptable. As an alternate, provide McGuire’s ProWrap p-trap kit with integral closed-cell, antimicrobial ADA coating provided with water supply covers.

PART 3 - EXECUTION

3.1 GENERAL APPLICATION:

A. Complete piping and equipment tests required by other sections before insulation is applied.

B. Apply insulation and sundries as recommended by the manufacturer. Install insulation with smooth and even surfaces, without bulges, protrusions, raw edges, or wrinkles. The jackets shall be drawn tight and secured smoothly at longitudinal and end laps with adhesive.

C. Apply insulation on clean, dry surfaces. All insulation shall be continuous through wall and ceiling openings and sleeves, except duct insulation shall terminate at fire dampers and flexible connections. Apply insulation on cold surfaces, where vapor barrier jackets are used, with continuous unbroken vapor barrier sealed to prevent condensation.

D. Seal ends of fiberglass pipe insulation with white vapor barrier coating at valves, flanges and fittings and on straight runs of piping not to exceed 21 ft.

E. Do not insulate unions.

F. Do not use scrap pieces of insulation where a full length section will fit.

G. Twist bonding wire terminals turned down into the insulation.

H. Staples will not be permitted in insulation nor on covering.

I. Construct insulation on equipment that must be opened periodically for inspection, cleaning or repair so that insulation can be removed and replaced without damage.

3.2 APPLICATION OF PIPE INSULATION:

A. Butt joints of pipe insulation together and secure jacket laps with lap adhesive. Seal butt joints with joint straps furnished with insulation.

B. Fittings, couplings, hubs, strainers and valve bodies in plumbing pipe shall be insulated with premoulded fitting insulation or with flexible glass fiber with one piece fitting cover.

C. Finish all fittings, valves and flanges in cold pipe lines with two 1/16" thick coats of a white vapor barrier coating, applied at not more than 25 sq. ft. per gallon, reinforced with 10 10 white glass fabric embedded between the two coats. Lap the glass fabric on itself and on adjoining pipe insulation at least two inches.

D. Finish all fittings, valves and flanges in hot pipe lines with two 1/16" thick coats of a white breather coating, applied at not more than 15 sq. ft. per gallon reinforced with 10 10 white glass fabric embedded between the coats. Lap the glass fabric on itself and on adjoining pipe insulation at least two inches.

END OF SECTION 220719

SECTION 221116 – DOMESTIC WATER 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 DESCRIPTION OF WORK:

A. Extent of the work is indicated on the Drawings and schedules and by the requirements of this section.

B. The construction requirements herein shall include appurtenant structures and buildings to which the system is to be installed.

C. Work under this section shall consist of furnishing and installing everything necessary for and incidental to the execution and completion of the domestic water distribution systems as indicated on the Drawings and specified herein.

D. Domestic Water Distribution systems shall be complete and operational in every respect and shall include all pipe, fittings, flanges, unions, equipment connections, sleeves, valves, strainers, supports and other appurtenances.

E. Refer to Specification 220719 Plumbing Piping Insulation for piping insulation requirements.

1.2 QUALITY ASSURANCE:

A. All pipe, valves and fittings shall comply with requirements as specified in this section of these specifications.

B. All pipe, valves and fittings furnished and installed under this section of these specifications shall be new and in first class condition.

C. All pipe, valves and fittings furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor’s expense.

D. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

E. Firms regularly engaged in manufacture of pipe, valves and fittings of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years are approved.

F. Installation contracting firm shall have at least five (5) years of successful installation experience on projects with domestic water piping systems work similar to that required for project.

G. Comply with applicable portions of Plumbing Code pertaining to plumbing materials, construction and installation of products.

H. Comply with applicable provisions of the American National Standards Institute pertaining to products and installation of domestic water piping systems.

I. Installation contracting firm shall have at least five (5) years of successful installation experience on projects similar to that required for this project.

1.3 SUBMITTALS:

A. Product Data, including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties and accessories, and installation instructions for each valve and domestic water piping specialty specified.

B. Maintenance Data for each valve and domestic water piping specialty specified, for inclusion in operating and maintenance manual.

C. Certification of compliance with ASTM and ANSI manufacturing requirements for pipe, fittings, and specialties.

D. Submit methods for joining piping including manufacturer’s data sheets on solder and flux proposed for use on this project.

1.4 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to job site in new and in first class condition.

B. Store pipe, valves and fittings utilizing suitable means so as to protect from weather, construction work traffic and contamination. Where pipe, valves and fittings are stored outdoors, Contractor shall cover in a suitable manner to prevent contamination from water, dirt, mud and/or debris. Pipe, valves and fittings shall not be laid on grade for storage.

C. Pipe, valves and fittings found to be contaminated with water, dirt, mud and/or other debris shall be cleaned and restored to new condition to the satisfaction of the Architect. Contaminated pipe, valves and fittings shall not be used until inspected. Pipe, valves and fittings determined to be unsuitable for use by the Architect shall not be used and shall be removed from the job site at the Contractor’s expense.

PART 2 - PRODUCTS

2.1 BASIC PIPE, TUBE, AND FITTINGS:

A. Aboveground Domestic Water Piping:

1. All Sizes Copper Tube:

a. Wall Thickness: Type L, hard drawn temper, ANSI B-88.
b. Fittings: Cast copper alloy solder joints, ANSI B16.18.
c. Fittings: Wrought copper, solder joints, ANSI B16.22.
d. Rolled grooved pipe and fitting & couplings 2”-8”.

e. Piping connections to booster pumps shall be with Type L copper with soldered or press type fittings. Type L copper piping may be used where connecting to flush valve type fixtures.
f. Pipe Sizes 3" and smaller:

(1) Solder: shall be 95-5 (tin-antimony), lead free solder conforming to ASTM B-32. Solder shall be Taramet Sterling as manufactured by Taracorp Industries or approved equal.
(2) Liquid and paste fluxes shall be lead free, compatible with solder, conforming to ANSI/NSF Standard 61 and ASTM B813:LA-CO Industries, Inc. - Flux Rite 90 Oatey Co., - H20.

2. All Sizes CPVC Tube:

a. Wall Thickness: Schedule 40 & 80, ASTM D 2486.
b. Runouts to flush valve fixtures and high pressure mains and risers 2” and larger shall be schedule 80 Corzan.

3. All Sizes PEX piping tubing:

a. Wall Thickness: Type A PEX tubing, ASTM F876.
b. Fittings: Uponor cold compression fittings.
c. Ball valves: Uponor brass ball valves, Nibco T-FP-600A-LF, Red-White 5044AB, Red-White 5018AB.
d. Low pressure piping up to 2” in size shall be PEX type A.

2.2 VALVES:

A. Gate valves:

1. Gate Valves 2" and smaller with solder ends shall be of Class 125 - 200 LB W.O.G., body and screw-in bonnet shall be of ASTM B-62 cast bronze composition, solid disc, copper silicon alloy stem, brass packing gland, Teflon-impregnated packing, and malleable handwheel.

RISING STEM	NON-RISING STEM
Crane 1700S	Crane 1701S
Grinnell 3010SJ	Grinnell 3000SJ
Hammond IB-635	Hammond IB-647
Milwaukee 149	Milwaukee 115
Nibco S-111	Nibco S-113
Powell 1821	Powell 1822
Stockham B-108	Stockham B-104

2. Gate Valves 2-1/2" and larger shall be of Class 125 - 200 LB W.O.G., iron body, bronze mounted, with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged ends with Teflon-impregnated packing and two piece packing gland assembly.

RISING STEM -OS&Y	NON-RISING STEM
Crane 465	Crane 461
Grinnell 6020A	Grinnell 6060A
Hammond IR-1140	Hammond IR-1138
Milwaukee F2885	Milwaukee F2882
Nibco F-617-O	Nibco F-619
Powell 1793	Powell 1787
Stockham G-623	Stockham G-612

B. Ball Valves:

1. Ball valves 2" and smaller shall be 600 psi CWP, have bronze bodies, replaceable reinforced Teflon seats, conventional port, blowout proof stems, stainless steel ball, solder ends with extended solder cups. Milwaukee BA-350-S or equivalent by Stockham or Nibco.

a. Apollo 82-200.
b. Grinnell 3810SJ.
c. Jamesbury.
d. Hammond 8503.
e. Milwaukee BA-350-S.
f. Nibco S-595-Y.
g. Powell.
h. Stockham.

C. Check valves:

1. Check Valves 2" and smaller with solder ends shall be of Class 125 - 200 LB W.O.G., body and caps shall be of ASTM B-62 cast bronze composition, swing-type bronze disc.

a. Crane 1707S.
b. Grinnell 3300S.
c. Hammond IB-912.
d. Milwaukee 1509.
e. Nibco S-413-B.
f. Powell 1825.
g. Stockham B-309.

D. Check valves 2” and smaller shall be of Class 125, solder ends, with bodies and caps conforming to ASTM B-62 cast bronze composition, swing type disc; NIBCO S-413-BYW or approved equal.

E. Globe valves 2” and smaller shall be of Class 125, body and bonnet of ASTM B-62 cast bronze composition, solder ends, copper silicon alloy stem, brass packing gland, Teflon-impregnated packing and malleable handwhell; NIBCO S-235-Y or approved equal.

F. Globe valves 2-1/2” and larger shall be of Class 125 iron body, bronze mounted with body and bonnet conforming to ASTM !-126 Class B cast iron, flanged end, with Teflon-impregnated packing and two-piece packing gland assembly; NIBCO F-178-B or approved equal.

2.3 UNIONS:

A. Unions shall be of the same material as the fittings specified and suitable for use at the working pressure and temperatures of the system in which they are installed.

B. Unions in piping 2-1/2" and smaller shall be threaded. Unions in piping 3" and larger shall be flanged. CPVC unions shall be solvent welded.

2.4 DIELECTRIC UNIONS:

A. Dielectric adapters shall be the union type for pipes 2" in size and smaller and flanged type for pipe 2-1/2" in size and larger. Adapters shall have working pressure of 250 psi for union type and 175 psi for flanged type. The insulating gasket shall have an operating range of 40°F to 240°F and shall limit the galvanic corrosion to a maximum of 1% of the short circuit current.

B. Dielectric adapters shall be Watts, Crane or Jameco.

2.5 TEMPERATURE AND PRESSURE RELIEF VALVES:

A. Temperature and pressure relief valves shall be A.G.A. temperature rated and ASME pressure rated and nameplated, and shall conform to ANSI Z21, 22. The operating limit of the relief valve shall not exceed 200° F. Valve shall be bronze body, non-stick or freeze seat to disc alignment, fully automatic, self -losing.

a. Watts Series 40, 1450, 240 and 340.
b. A.W. Cash FV, Series 2.

Valves Size	Equipment Max. BTU/Hr input
1/2”	15,000
3/4”	200,000
1”	2,000,000
1-1/2”	3,000,000

2.6 WATER HAMMER ARRESTORS:

A. Subject to compliance with requirements, provide water hammer arrestors of one of the following:

a. Mifab
b. Josam Manufacturing Co.
c. Precision Plumbing Products.
d. Sioux Chief Industries
e. Jay R. Smith Mfg. Co.
f. Wade Div., Tyler Pipe.
g. Watts Industries, Inc.
h. Zurn Industries, Inc., Hydromechanics Div.

B. Piston Type Water Hammer Arrestors shall be copper body, with brass piston and cap, EPDM seals and O-rings, factory air charged, permanently capped and epoxy sealed. Piston Type Water Hammer Arrestors shall comply with ASSE 1010, and ANSI 112.26.1M, and be tested and certified in accordance with PDI Standard WH-201 and shall be installed on the hot water and cold water piping at the connection to each fixture group and where shown on drawings. Piston Type Water Hammer Arrestors shall be Watts #15, or equivalent.

2.7 NON-FREEZE HYDRANTS:

A. Provide non-freeze hydrants of one of the following manufacturers:

1. Woodford Mfg. Co.
2. Josam Mfg. Co.
3. Jay R. Smith Mfg. Co.
4. Wade Div., Tyler Pipe.
5. Zurn Industries Inc., Hydromechanics Div.

B. Hydrants:

1. Recessed Non-Freeze Wall Hydrants: Cast-bronze box hydrant, chrome plated face, loose tee handle key, bronze casing, length to suit wall thickness, vacuum breaker, hinged locking cover, 3/4" inlet, hose outlet.

2. Non-Freeze Hose Bibbs shall be chrome plated face, loose tee handle key, bronze casting, length to suit wall thickness, vacuum breaker, 3/4" inlet, hose outlet.

2.8 ISOLATION VALVES:

A. Install ball valve or gate valve as specified at the connection to each fixture group and where shown on drawings. Only one ball valve shall be provided per residential unit.

2.9 HOSE BIBBS AND DRAIN VALVES:

A. Hose Bibbs:

1. Threaded End: Bronze body, non-rising stem renewable composition disc, 3/4" NPT inlet, 3/4" hose outlet with vacuum breaker, cap and chain.

2. Hose bibbs in mechanical rooms and building service areas shall be rough bronze body, lock shield, wall flange, with vacuum breaker and threaded inlet.

3. Hose bibbs in finished areas shall be chrome plated bronze body, lock shield, wall flange, with vacuum breaker and loose key.

B. Drain Valves:

1. Threaded End: Bronze body, non-rising stem renewable composition disc, wheel handle, 3/4" NPT inlet, 3/4" hose outlet. Drain valve shall be:

a. Nibco - Model 73.
b. Watts Regulator BD-1.
c. Woodford 24.

2.10 FLOOR, WALL AND CEILING PLATES:

A. Where exposed piping, bare and insulated, passes through floors, walls and ceiling in finished areas only, escutcheons shall be provided. Escutcheons shall be chrome-plated steel plates. Escutcheons shall be as manufactured by Bea-Cor, F&S or Grinnell. Escutcheons for chrome plated connections at plumbing fixtures shall be as specified under the plumbing fixtures.

2.11 THERMOMETERS:

A. Thermometers shall be red-reading mercury filled adjustable angle type. Thermometer shall be adjustable to any angle through a 180° arc and shall be provided with a locking device. Thermometer shall have V-cast aluminum case with baked enamel finish and 9" scale. Thermometers shall be provided with separable sockets and, where installed on insulated pipes, sockets shall be extension neck type.

B. Thermometer scale range shall be 60 to 200°F.

C. Thermometers shall be Weksler Adjust-Angle Series Type AA-5, Trerice Adjustable Angle Series Type BX or Weiss Vari-Angle Series Type VS. Thermometers shall be permanently installed in the 3/4" aquastat opening in each domestic hot water storage tank. Thermometers are only required on non-residential, tank-type water heaters.

2.12 PRESSURE GAUGES AND GAUGE COCKS:

A. Gauges shall be flangeless type and shall have 4 -1/2" dials, cast aluminum cases, stainless steel rotary gear movement, phosphor bronze bourdon tubes, forged brass rod sockets and tips, 1/2% accuracy of scale range, plexiglass dial covers, safety blow-out disc and 1/4" lower connections. Gauges shall be Gerand, Trerice or Weiss. Scale range shall be suitable for the pressure ranges in which they are to operate, and in accordance with the following:

1. System with working pressure less than 100 PSIG: Scale range 0-150 PSI.

B. Gauge pointer shall be micrometer adjustment type, recalibrated from the front of the gauge.

C. Gauges in pump suction lines shall be the compound type. Gauges in all other locations shall be the plain pressure type.

D. Each gauge shall be supplied with a needle valve type gauge cock suitable or the pressure and temperature of the system in which it is installed, and compatible with the gauge to which it attaches.

E. Pressure snubbers shall be provided on gauges at pump suction and pump discharge piping and an other location subject to rapidly fluctuating pressures or sudden shock pressures. Snubbers shall be the porous metal type capable of an equilibrium pressure reading within 10 seconds of a pressure change.

F. Pressure gauges and gauge cocks shall be installed at the suction and discharge of each pump, at the inlet and outlet of chiller at the discharge of each pressure reducing valve, at water service outlet and at other locations shown on the Drawings. Pressure gauges not required on residential unit regulators.

2.13 STRAINERS:

A. Y-Pattern Strainers Two Inches (2") and Smaller: 150 psig working pressure cast bronze body (ASTM B-62), threaded ends, threaded and gasketed cap, Type 304 stainless steel screen, and bottom drain connection (Equivalent to Mueller #351).

B. Y-Pattern Strainers Two and One-Half Inches (2-1/2") and Larger: 125 psig working pressure cast bronze body (ASTM B-62), flanged ends, bolted cover, perforated Type 304 stainless steel basket, and bottom drain connection (Equivalent to Mueller #851).

C. Strainer screens and baskets shall be stainless steel and shall conform to the following:

Service	Perforation	Open Area
1/4" - 2"	20 Mesh	52%
2-1/2" - 4"	.0625"	41%

PART 3 - EXECUTION

3.1 GENERAL:

A. Contractor shall not fabricate and/or install domestic water piping until Architect/Engineer has reviewed shop drawings / submittals for compliance with engineering design concept.
B. Any domestic water piping fabricated and/or installed prior to the Architect/Engineer's review found to be in non-compliance shall be removed or corrected as per instructions from Architect/Engineer at Contractor's expense.
C. Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in domestic water piping systems.
D. Where more than one type of material or product is indicated, selection is Installer's option, however, systems of piping must remain consistent in the type of materials and fittings utilized.

3.2 PIPE SLEEVES:

A. Pipes passing through concrete and masonry walls and partitions and through concrete floor shall be provided with pipe sleeves which shall be installed during construction of walls, partitions and floors. All pipe sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors and roof are constructed. No sleeves required through drywall partitions. Hilti sleeves (or equal) are permitted.

1. Sleeves are not required for water and waste connections through a wall or partition to an individual fixture.
2. Sleeves are not required for cast-iron pipe through concrete slab on grade.
3. Sleeves shall not be installed in structural members except as detailed on structural drawings, or as reviewed by Structural Engineer.

B. Install sleeves accurately centered on pipe runs so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion. Where insulation includes vapor barrier jacket, provide sleeve with sufficient clearance for installation.

C. Sleeve materials, sizes, lengths, and sealing shall be as described in Section 23 05 00 of these specifications.

D. Where exposed piping, bare and insulated, passes through floors, walls and ceiling, except in Mechanical Rooms, escutcheons shall be provided. Escutcheons shall be chrome-plated steel plates, hinged type with set screw. Escutcheons shall be as manufactured by Bea-Cor, F&S or Grinnell. Escutcheons for chrome plated connections at plumbing fixtures shall be as specified under the plumbing fixtures.

E. All pipe penetrations shall be sealed in accordance with the details shown on Drawings and/or noted in these Specifications.

F. Insulated piping passing through fire-rated walls or floors must have the pipe insulation interrupted on both sides of the fire-rated wall/floor penetrations as shown on Drawings.

3.3 INSTALLATION:

A. Extend water service piping of size and in location indicated to water service entrance at building. Provide sleeve in foundation wall for water service entry; make entry watertight. Provide gate valve at water service entry inside building, strainer, pressure gauge and drain valve with hose end connection.

B. Install pipe, valves and fittings in accordance with recognized industry practices which will achieve a permanently leakproof piping system, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Align piping accurately at connections, within 1/16" misalignment tolerance. Do not spring or force piping into place. Install piping in such a manner as to prevent strain on equipment connections.

C. Locate piping runs, except as otherwise indicated, vertically and horizontally. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access or servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to one-half (1/2") where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for one (1.0") inch clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings. Residential hot water PEX piping shall be run from the water heater to each fixture individually, not parallel to walls, etc.

D. All piping shall be made up and installed in a manner that permits expansion and contraction caused by changes in temperature and pressure. This shall be accomplished by the use of expansion loops as required and by installation of supports that will permit the movement of the pipe without undue stress, and by any other precautions that might be deemed necessary by the Engineer.

E. Do not run piping through any transformer vault, electric switchgear room, electrical closet, elevator equipment room, or electronic equipment space.

F. All piping shall be carefully graded so as to eliminate water taps and air pockets. Where air pockets or water traps cannot be avoided, provide means for drainage with valve hose connection. Provide automatic air vents as specified for air pockets and all system high points.

G. Equipment Connections: Connect piping system to equipment as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated. Install shutoff valve and union on supply and return, and drain valve on drain connection.

H. All screwed and flanged piping connections (especially dielectric connections) shall be accessible for repair. All piping connections in concealed, inaccessible locations, such a chases or furred ceilings, shall be brazed. All valves, controllers, gauges, thermometers, etc., shall be accessible.

I. All valves and piping accessories shall be located so as to be accessible for operation and maintenance.

J. Piping which is located above ceilings or behind walls in chases shall be positioned so that operations and maintenance may be performed through access panels and/or ceiling grid.

3.4 INSTALLATION OF PIPE SUPPORTS:

A. Refer to Section 23 05 29 for general pipe support information.

B. Provide, as a minimum, one (1) support at each elbow, tee, valve, change of direction, branch and equipment connection.

3.5 INSTALLATION OF VALVES:

A. Install sectional valves close to main, on each branch and riser, and elsewhere as indicated.

B. Install shutoff valves on inlet of each piece of plumbing equipment and elsewhere as indicated. Provide reducers, adapters and unions for assembly of piping.

C. Install drain valves on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain domestic water piping system.

D. Install check valves on discharge side of each pump, and elsewhere as indicated.

E. Install balancing valves in each hot water recirculating branch and elsewhere as indicated and required to properly balance the hot water recirculating system. Locate valves in accessible location. Provide access panel as required to access valve.

3.6 PIPE THREADING:

A. All threaded pipe shall be fabricated in accordance with ANSI B2.1. Threads shall be cut full and clean using harp dies.

B. Threaded ends shall be reamed to remove burrs and restore full inside diameter of the pie.

C. Apply pipe joint compound or Teflon tape on the male threads at each joint and tighten joint to leave not more than three (3) threads exposed.

3.7 SOLDER JOINTS:

A. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tub end and inside of fittings. 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.

B. Solder joints in any pressure piping shall be done with a 95-5 tin-antimony solder with an approved type flux.

C. Copper tube shall be joined in accordance with ASTM B828. All copper tube shall be installed in accordance with recommended procedures of the Copper Development Association Handbook.

3.8 INSTALLATION OF UNIONS:

A. Unions for the isolation of equipment from piping shall be of the same material as the fittings specified and suitable for use at the working pressure and temperatures of the system in which they are installed.

B. Unions in piping 2-1/2" and smaller shall be threaded. Unions in piping 3" and larger shall be flanged. CPVC unions shall be solvent welded.

C. Unions shall be installed where necessary or as indicated on the drawings to accommodate the proper installation, servicing and removal of all equipment.

3.9 INSTALLATION OF DELECTRIC UNIONS:

A. All connections between dissimilar metals subject to galvanic action shall be made with an insulating type dielectric adapter.

B. Provide a dielectric union between any connection of dissimilar metals including piping and equipment.

C. Flexible connections at pumps shall be 150 psi flanged fabric reinforced neoprene having a length equal to or greater than the pipe diameter, except on systems subject to pressures greater than 150 PSIG, where flexible connections shall be rated for 300 PSI.

D. No insulating type dielectric adapter or connection between dissimilar metals shall be installed in an inaccessible area.

3.10 INSTALLATION OF WATER HAMMER ARRESTORS:

A. Install water hammer arrestors/shock absorbers in upright position, in locations and of sizes in accordance with PDI Standard WH-201, and elsewhere as indicated on the Drawings. Water hammer arrestors shall be provided at all quick close valves/fixtures as required by Code (when not integral to the fixture itself).

B. Where shock absorbers, trap primers, unions or valves are concealed behind walls or above inaccessible ceilings, provide access panels.

C. Piston type water hammer arrestors shall be installed on the hot water and cold water piping at the connection to every fixture group on the fixture side of the isolation valve.

3.11 INSTALLATION OF THERMOMETERS AND GAUGES:

A. Install thermometers and gauges in accordance with design drawings.

3.12 INSTALLATION OF STRAINERS:

A. Install strainers on the entering side of each pressure reducing valve, pressure regulating valve, and elsewhere as indicated on the drawings. Strainer shall be installed so that the filter screen may be easily removed for inspection and cleaning.

3.13 EQUIPMENT CONNECTIONS:

A. Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by the equipment connections.

B. Connect hot and cold water piping system to mechanical equipment as indicated, and comply with equipment manufacturer's installation instructions. Provide shutoff valve and union for each connection, provide drain valve on drain connection.

C. All piping rough-in or piping not completed at the end of the day shall be provided with temporary caps or plugs to prevent the entrance of foreign material during the construction period, until such time as piping is extended or final connections are made to fixtures.

3.15 TESTING OF THE PIPING SYSTEM:

A. Upon completion of the rough-in and before setting fixtures, test pressure piping in accordance with ANSI B31. Do not insulate any piping or allow piping to become concealed until it has been thoroughly and properly tested. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemical, stop-leak compounds, mastics, or other temporary repair methods.

B. The entire hot and cold water piping system shall be tested at a hydrostatic pressure of not less than 100 pounds per square inch gauge and proven tight at this pressure for not less than four (4) hours or as recommended by the piping manufacturer. The water used for these test shall be obtained from a potable source of supply. Where a portion of the water piping is to be concealed before completion, this portion shall be tested separately in a manner described for the entire system

1. Piping which is to be subjected to working pressure greater than 80 psi must be tested at not less than 50 psi above the working pressure.

C. All components which may not be rated to withstand the test pressures must be isolated and protected from damage.

D. System shall maintain pressure and shall be checked for leaks. Any leaks shall be repaired to the satisfaction of the Owner's Representative and the system retested.

E. Drain test water from piping system after testing and repair work has been completed.

F. After water piping systems have been pressure tested and approved for tightness, they shall be thoroughly cleaned, flushed, and sterilized.

G. Upon the satisfactory completion and final test of the plumbing system, the Contractor shall obtain from the proper authority having jurisdiction and shall deliver to the Owner's Representative a Certificate of Review thereof. One (1) additional copy of test reports and approval by the local inspector shall be submitted to the Architect/Engineer.

3.16 FLUSHING AND STERILIZATION:

A. All potable water piping must be sterilized in accordance with the requirements of the local authority having jurisdiction. As a minimum, the system shall be filled with a chlorine compound solution of at least 50 ppm and allowed to stand for 12 hours or as recommended by the piping manufacturer. The system must then be flushed until the residual chlorine is a maximum of 2 ppm.

B. Furnish three copies of a Certificate of Performance of Complete Sterilization to the Owner's Representative before final inspection of the work, all certified by a registered Chemical Engineer.

3.17 SPARE PARTS:

A. Furnish to Owner, with receipt, one (1) valve key for each key operated hydrant, bibb, or faucet installed.

END OF SECTION 221116

SECTION 221316 – SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 21 Specifications, and Division 01 Specification Sections, apply to this Section.

B. Refer to Division 22000 for specifications for piping, insulation, general requirements.

1.2 DESCRIPTION OF WORK:

A. Extent of soil and waste piping work, is indicated on drawings and schedules.

1.3 QUALITY ASSURANCE:

A. Manufacturing firms shall be regularly engaged in the manufacture of piping sanitary drainage products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installation contracting firms shall comply with applicable portions of Code pertaining to plumbing materials, construction and installation of products.

C. Comply with applicable American National Standards pertaining to products and installation of soil and waste piping systems.

D. Comply with applicable Plumbing and Drainage Institute Standards pertaining to products and installation of soil and waste piping systems.

1.4 SUBMITTALS:

A. Submit manufacturer's data for soil and waste piping systems materials and products.

PART 2 - PRODUCTS

2.1 SOIL AND WASTE PIPING MATERIALS AND PRODUCTS:

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in soil and waste piping systems. Where more than one (1) type of materials or products are indicated, selection is Installer's option.

2.2 BASIC PIPE, TUBE, AND FITTINGS:

A. Aboveground Piping Within Building, Vertical: CISPI Cast Iron Soil Pipe with no-hub couplings, or Schedule 40 PVC DWV with solvent weld fittings. Schedule 40 PVC piping may be utilized as long as the piping is not located in a plenum space. In that instance, the PVC piping is to be either fire wrapped or schedule 40 CPVC piping is to be used instead.

B. Aboveground Piping Within Building, Horizontal: Schedule 40 PVC DWV with solvent weld fittings.

C. Underground Building Drain Piping: Cast Iron Hub and Spigot soil pipe, ASTM A74

1. Pipe Class: Service Weight (SV)

2. Fittings: Cast Iron Hub and Spigot soil pipe fittings.

3. Gaskets: Neoprene compression gasket joints, ASTM C-564.

4. PVC drain piping is acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION:

A. Install mechanical identification in accordance with division 23 "Identification of Piping Systems".

3.2 INSTALLATION OF PIPING:

A. Install soil and vent piping pitched to drain at minimum slope of 1/4" per foot for piping 2" and smaller, and 1/8" per foot for piping 3" and larger.

3.3 EQUIPMENT CONNECTIONS:

A. Provide soil and waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by Plumbing Code.

3.4 PIPING TESTS:

A. Test soil and waste piping for pressure maintenance before any backfilling or wall closing. Piping shall be tested with 10 feet of water for two hours with no drop of water height.

END OF SECTION 221316

SECTION 221319 – SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 REFERENCES:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 21 Specifications, and Division 01 Specification Sections, apply to this Section.

B. Refer to Division 22000 for specifications for piping, insulation, general requirements.

1.2 QUALITY ASSURANCE

A. All plumbing drains, cleanouts, and accessories shall comply with requirements as specified in this section of these specifications.

B. All plumbing drains, cleanouts, and accessories furnished and installed under this section of these specifications shall be new and in first class condition.

C. All plumbing drains, cleanouts, and accessories furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor’s expense.

D. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

E. Firms regularly engaged in manufacture of plumbing drains, cleanouts, and accessories of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years are approved.

1.3 SUBMITTALS

A. Submit data on each item proposed to be furnished on this project. Submittal to include manufacturer’s name and model number, sizes, materials, finishes, dimensional data, required clearances, weights, capacities (where applicable), and installation instructions.

B. Maintenance Data - Submit maintenance data and parts lists for each item. Include "trouble-shooting" maintenance guides. Include this data in maintenance manual.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in new and in first class condition.

B. Store plumbing drains, cleanouts, and accessories utilizing suitable means so as to protect from weather, construction work traffic and contamination. Where plumbing drains, cleanouts, and accessories are stored outdoors, Contractor shall cover in a suitable manner to prevent contamination from water, dirt, mud and/or debris. Plumbing drains, cleanouts, and accessories shall not be laid on grade for storage.

C. Plumbing drains, cleanouts, and accessories found to be contaminated with water, dirt, mud and/or other debris shall be cleaned and restored to new condition to the satisfaction of the Architect. Contaminated plumbing drains, cleanouts, and accessories shall not be used until inspected. Plumbing drains, cleanouts, and accessories determined to be unsuitable for use by the Architect shall not be used and shall be removed from the job site at the Contractor's expense.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide drains, cleanouts & drainage accessories of one of the following manufacturers:

1. Josam Mfg. Co.
2. Jay R Smith Mfg. Co.
3. Wade div., Tyler Pipe
4. Mifab Industries

2.2 GENERAL

A. Provide factory fabricated drainage piping products of the size and type as indicated on drawings, including features as specified herein. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and governing regulations.

B. Refer to section 220500 "Common Work Results for Plumbing" for additional floor drain and cleanout requirements.

C. Roof drains shall be rated for flow indicated on drawings. Alternate manufactures from basis of design are acceptable given they meet or exceed the flow rate requirements shown within contract documents.

2.3 FLOOR DRAINS

A. All floor drains shall be provided with trap primers unless subject to regular active flow. Regular active flow shall be defined as the flow received by a floor drain in a shower, mop basin, or other similar application.

B. All floor drains not required by this specification to be provided with trap primers shall be provided with deep seal "P" traps.

C. All floor drains located on elevated floors shall be provided with seepage holes and flashing collar or clamping rings to provide for leak proof installation.

D. Trap primers for floor drains as scheduled shall be passive type fed from lavatory waste by Josam or J.R. Smith. Where a lavatory is not nearby, a trap primer valve shall be used. Trap guards can be provided as a substitute to trap primers.

2.4 CLEANOUTS

A. All floor cleanouts shall have cast iron body and frame, cleanout plug and neoprene seal with adjustable round housing, spigot or inside caulk, and cover type as required to match final floor finish. Cleanouts in PVC may be PVC cleanout plugs with chrome plated or paintable cover plates.

B. Wall cleanouts for vertical piping 6" size and smaller shall consist of a cast iron cleanout tee with threaded cast bronze or brass cleanout plug with round stainless steel secured access cover.

C. Base cleanouts 6" size and smaller shall consist of a cast iron cleanout tee with threaded cast bronze or brass cleanout plug with raised head.

D. Floor cleanouts shall have cast iron body and frame, brass cleanout plug and neoprene gasket seal with adjustable round housing, spigot or inside caulk, and cover type as required to match final floor finish.

1. Vinyl Tile or Rubber Tile Floor shall have secured round nickel bronze top with recess to accommodate tile.

2. Ceramic Tile Floor shall have secured round scoriated nickel bronze top.

3. Carpeted Floor shall have secured round scoriated nickel bronze top with carpet marker.

4. Unfinished Concrete Floors shall have heavy-duty secured round scoriated nickel bronze top

E. Exterior cleanouts shall have cast iron body and frame, brass cleanout plug and neoprene gasket seal with adjustable round housing, spigot or inside caulk, and cover type as follows:

1. Exterior Paved or Concrete areas shall have heavy duty ecured round scoriated nickel bronze top.

2. Exterior unsurfaced areas shall have heavy duty secured round scoriated nickel bronze top set in 12” x 12” x 4” thick concrete pad.

2.5 FLASHINGS

A. Roof flashings shall be by Roofing Contractor.

B. Stack flashing fittings shall be counterflashing type, cast iron fitting, with bottom recess for termination of roofing membrane, and hub top for extension of the vent pipe to proper elevation. Jay R. Smith 1740 or approved equal.

C. Vent caps shall be cast iron body, with hub inlet, and vented hood. Vent caps shall be of vandal proof design, with Allen Key set screws to secure assembly to vent pipe

D. Roof flashing assemblies shall be manufactured type, consisting of 4 lb. per square foot lead flashing collar, with skirt extending 12” minimum from pipe, 12” high collar, galvanized steel boot reinforcement and counterflashing fitting.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall not purchase and/or install drains, cleanouts or accessories until Architect/Engineer has reviewed shop drawings / submittals for compliance with engineer design concept.

B. Any drains, cleanouts or accessories purchased and/or installed prior to the Architect/Engineer's review found to be in non-compliance shall be removed or corrected as per instructions from Architect/Engineer at Contractor's expense.

3.2 INSTALLATION OF FLOOR DRAINS

A. Exact location and top elevation of all drains and cleanouts must be coordinated with architectural and structural drawings.

B. Install floor drains at low points of surface areas to be drained and as indicated. Set top of drains flush with finished floor.

C. Install floor drains in accordance with manufacturer's written instructions and in locations indicated.

D. Coordinate with soil and waste piping as necessary to interface floor drains with drainage piping systems.

E. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

F. During construction drains shall be kept covered so that traps and sediment buckets are kept free from debris and trash and to protect surface of drains located in finished areas.

G. All floor drains and cleanouts shall have finishes protected from damage during construction.

H. Position drains so that they are accessible and easy to maintain.

I. All floor drain strainers shall be securely fastened to drain body.

J. All floor drain grates and cleanout covers deformed by heavy construction traffic shall be replaced.

3.3 INSTALLATION OF CLEANOUTS

A. Install cleanouts in sanitary above ground piping and sanitary building drain piping as indicated on the drawings and as required by the applicable Plumbing Code at each change in direction of piping greater than 45 ˚. Cleanouts shall be installed at intervals set forth by the applicable Plumbing Code, but not to exceed 75 feet.

B. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.

C. Install cleanouts at the base of vertical soil or waste stacks serving two (2) or more floors with centerline of cleanout 1'-6" above finished floor maximum unless noted otherwise. Coordinate cover with adjacent wall finish.

D. Roofing Contractor to install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

E. Roofing Contractor to install vent flashing sleeves on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

F. Install cleanouts in accessible locations with a minimum of 18” clearance from walls, equipment, etc.

3.4 INSTALLATION OF FLASHINGS

A. All pipes penetrating the roof shall be flashed. Flashing materials and methods shall be coordinated with and compatible with roofing system installed on this project.

B. All pipes penetrating the exterior wall shall be sealed watertight and provided with escutcheons.

END OF SECTION 221319

SECTION 221400 – STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 21 Specifications, and Division 01 Specification Sections, apply to this Section.

B. Refer to Division 22000 for specifications for piping, insulation, general requirements.

1.2 DESCRIPTION OF WORK:

A. Extent of storm water piping work is indicated on drawings and schedules.

1.3 QUALITY ASSURANCE:

A. Manufacturing firms shall be regularly engaged in the manufacture of piping sanitary drainage products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installation contracting firms shall comply with applicable portions of Code pertaining to plumbing materials, construction and installation of products.

C. Comply with applicable American National Standards pertaining to products and installation of soil and waste piping systems.

D. Comply with applicable Plumbing and Drainage Institute Standards pertaining to products and installation of soil and waste piping systems.

1.4 SUBMITTALS:

A. Submit manufacturer's data for soil and waste piping systems materials and products.

PART 2 - PRODUCT

2.1 STORM WATER PIPING MATERIALS AND PRODUCTS:

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in soil and waste piping systems. Where more than one (1) type of materials or products are indicated, selection is Installer's option.

2.2 BASIC PIPE, TUBE, AND FITTINGS:

A. Aboveground Piping Within Building, Vertical: CISPI Cast Iron Soil Pipe with no-hub couplings, or Schedule 40 PVC DWV with solvent weld fittings. Piping in return air plenums to be Cast

Iron or Schedule 40 CPVC.

B. Aboveground Piping Within Building, Horizontal: Schedule 40 PVC DWV with solvent weld fittings. Piping in return air plenums to be Cast Iron or Schedule 40 CPVC.

C. Underground Building Drain Piping: Cast Iron Hub and Spigot soil pipe, ASTM A74

1. Pipe Class: Service Weight (SV)

2. Fittings: Cast Iron Hub and Spigot soil pipe fittings.

3. Gaskets: Neoprene compression gasket joints, ASTM C-564.

4. PVC drain piping is acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION:

A. Install mechanical identification in accordance with division 23 "Identification of Piping Systems".

3.2 INSTALLATION OF PIPING:

A. Install storm water piping pitched to drain at minimum slope required to accommodate the rainfall rate, pipe size, and area served.

B. Notify engineer if calculated pipe sizing varies from that indicated on drawings.

3.3 PIPING TESTS:

A. Test soil and waste piping for pressure maintenance before any backfilling or wall closing. Piping shall be tested with 10 feet of water for two hours with no drop of water height.

END OF SECTION 221400

SECTION 223400 - 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 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 and the unit will be fully operational after the seismic event."

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, 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.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

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. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: Three years.
2) Controls and Other Components: Two years.
3) Controls and Other Components: [Two] [Three] <Insert number> years.

b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial water heater natural gas water heater(s) shall be A. O. Smith Cyclone MXi model BTH-199, minimum 97% thermal efficiency, a storage capacity of 100 gallons (379 Liters), an input rating of 199,900 BTUs per hour, a recovery rating of 235 gallons per hour (gph) at 100°F rise and a maximum hydrostatic working pressure of 160 psi.

B. Modulating gas burner that automatically adjusts the input based on demand.

C. Powered anodes that are non-sacrificial and maintenance free.

D. Have seamless glass-lined steel tank construction, with glass lining applied to all water-side surfaces after the tank has been assembled and welded

E. Have foam insulation and a CSA Certified and ASME rated T&P relief valve

F. Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up

G. Be approved for 0″ clearance to combustibles. The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout.

H. 120K-250K BTU Input: For Standard Power Venting: Water heater(s) shall be suitable for power venting using a (3″ or 4″) diameter PVC pipe for a total distance of (50 ft or 120 ft.) equivalent feet of vent piping. For Power Direct Venting: Water heater(s) shall be suitable for power direct venting using a (3″ or 4″) diameter PVC pipe for a total distance of (50 ft or 120 ft.) equivalent feet of vent piping and (50 ft. or 120 ft.) equivalent feet of intake air piping. Vent piping shall be Centrotherm Innoflue Single wall system or equal.

I. Operation of the water heater(s) in a closed system where thermal expansion has not been compensated for (with a properly sized thermal expansion tank) will void the warranty.

J. Power supply of 120V/1PH, 60 Hz.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:

1. 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.

2. 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.

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. Drain pan shall be 2” larger then footprint of water heater in all directions and be 2” high.

C. Heat-Trap Fittings: ASHRAE 90.2.

D. 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 memory-stop balancing valves to provide balanced flow through each domestic-water heater.

E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

F. 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.

G. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

H. 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 457 mm above the floor.

I. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

J. Provide with acid neutralization kit from water heater manufacturer. Acid neutralization kit shall drain to nearby floor drain.

K. Provide with leak detection kit from water heater manufacturer.

L. Provide with low profile vent termination kit from water heater manufacturer. Vent termination shall be paintable to match building façade.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters and storage tanks 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 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "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. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

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. 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.

C. 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.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 Natural-Gas Piping."

D. 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.

E. 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.

F. Install thermometer on outlet piping of domestic-water heaters.

G. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

H. Fill domestic-water heaters with water.

I. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for fuel-oil piping specified in Section 231113 "Facility Fuel-Oil Piping."

C. Comply with requirements for gas piping specified in Section 231123 Natural-Gas Piping.

D. Drawings indicate general arrangement of piping, fittings, and specialties.

E. 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 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. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. 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 commercial, gas-fired, storage domestic-water heaters.

END OF SECTION 223400

SECTION 230500 - COMMON WORK RESULTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This division and the accompanying Drawings cover furnishing of all labor, equipment, appliances, and materials and performing all operations in connection with the installation of complete air conditioning, ventilating, heating, plumbing and fire protection systems specified herein and as shown on the Drawings.

B. Provide complete, operational heating, ventilating, air conditioning, plumbing and fire protection systems as indicated on the Drawings and as specified hereinafter.

1.2 DEFINITIONS

A. "Owner's Representative" means the Architect.

B. "Approved" means approved in writing by the Owner or Owner's Representative.

C. "Subcontractor" means the successful bidder furnishing and installing the work under this specification.

D. "Bidder" means individuals or firms proposing to furnish materials, labor and equipment for this project.

E. "Vendor" means individuals or firms furnishing materials or equipment for this project.

F. "Provide" means furnish and install.

1.3 CODES AND REGULATIONS

A. Materials and workmanship shall comply with the following codes and standards, as applicable:

1. The International Building Code (2012)
2. The International Mechanical Code (2012)
3. The International Plumbing Code (2012)
4. The International Energy Conservation Code (2009)
5. The National Electrical Code (2014)
6. The International Fire Code (2012)
7. The International Fuel Gas Code (2012)
8. The National Fire Protection Association Codes and Standards, including, but not limited to: No. 13, 14, 20, 24, 30, 54, 70, 90, 91, 96 and 101, latest editions.
9. Safety Code for Mechanical Refrigeration, ANSI/ASHRAE 15, latest edition.
10. Current Georgia Amendments to The International Code.

B. Applicable Standards, Specifications, and Codes:
The standards, specifications, and codes listed below form a part of this specification to the extent referenced. Contractor shall comply with the latest current applicable standards, specifications, and/or codes as follows:

1. Associated Air Balance Council (AABC)

2. American Air Movement Association (AAMA)
3. Americans with Disabilities Act (ADA)
4. Air Diffusion Council (ADC)
5. American Gas Association Inc. Laboratories (AGA)
6. Air Movement and Control Association, Inc. (AMCA)
7. American National Standards Institute, Inc. Standards (ANSI)
8. The Air-Conditioning, Heating and Refrigeration Institute Standards (AHRI)
9. American Society of Mechanical Engineers Code (ASME)
10. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
11. American Society of Sanitary Engineering (ASSE)
12. American Society for Testing and Materials Publications (ASTM)
13. American Water Works Association (AWWA)
14. Cast Iron Soil Pipe Institute (CISPI)
15. Factory Mutual Underwriters (FM)
16. National Electrical Manufacturer's Association (NEMA)
17. National Fire Protection Association Standards (NFPA)
18. Occupational Safety and Health Administration (OSHA)
19. Sheet Metal and Air Conditioning Contractors' National Association Inc. (SMACNA)
20. Underwriters Laboratories Inc. (UL)
21. Canadian Standards Association (CSA)

C. All work done under this Contract shall comply with all state and local codes having jurisdiction and with the requirements of the Utility Companies whose services may be used. All modifications required by these codes shall be made by the Contractor at no addition to the cost of the Contract. Any conflict between these documents and the governing codes shall be immediately brought to the attention of the Engineer of Record. Where code requirements are less than those shown on the Plans or in the Specifications, the Plans and Specifications shall govern.

D. The Contractor shall comply with all applicable provisions of the William-Steiger Occupational Safety and Health Act (O.S.H.A.).

1.4 PERMITS AND REGULATIONS

A. The Contractor shall secure all permits, inspections, and approvals as required by all authorities having jurisdiction. All fees pertaining to these permits, inspections and approvals shall be assumed and paid by the Contractor.

B. Contractor shall not proceed with any portion of the work until after he has paid for and obtained all necessary permits.

C. Contractor shall turn over all construction inspection certificates to Architect before request for final payment.

1.5 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section and Section 23 05 01, to expand the requirements specified:

1. Coordination drawings.
2. Record documents.
3. Rough-ins.

4. Mechanical installations.
5. Cutting and patching.
6. Mechanical equipment and piping identification.

B. Related Sections Example: The following sections contain requirements that relate to this section:

1. Section 23 05 01 "Schedule of Submittal Data," for submittal information and Operating and Maintenance Manuals requirements.
2. Section 23 05 13 "Common Motor Requirements for Equipment," for factory or field installed motors, controllers, accessories, and connections.
3. All other Mechanical Specification Sections.
4. Electrical all applicable sections.

1.6 QUALITY ASSURANCE

A. All equipment, material, and workmanship shall comply with requirements as specified in this section of these specifications.

B. All equipment and material furnished and installed under this section of these specifications shall be new and in first class condition.

C. All equipment shall be new and bear the Underwriter’s Laboratories, Inc. (UL) label unless specifically indicated otherwise.

D. Provide equipment complete with all components and accessories necessary to provide a complete and properly operating installation.

E. All equipment and material furnished and/or installed by Contractor shall be manufactured by firms regularly engaged in the manufacture of those products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

F. Listing manufacturers name in this Division does not infer conformity to all requirements of the Contract Documents nor waive requirements thereof.

G. All equipment and material furnished and installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications without increase in the contract amount.

H. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver all equipment and material to job site in new and first class condition. Material or equipment that is rusted, soiled or otherwise contaminated shall not be permitted for use.

B. Store equipment and material utilizing suitable means so as to protect from weather, construction work traffic and contamination. Where either equipment or material are stored outdoors, Contractor shall cover in a suitable manner to prevent contamination from water, dirt, mud and/or debris. Equipment and material shall not be laid on grade for storage.

C. Equipment or material found to be contaminated with water, dirt, mud and/or other debris shall be cleaned and restored to new condition to the satisfaction of the Architect/Engineer. Contaminated equipment or material shall not be used until inspected and certified “like new.”

D. Damaged equipment or material shall not be used and shall be removed from the job site and replaced without increase in the contract amount.

1.8 REFERENCES TO OTHER DIVISIONS

A. The following work is specified under other Divisions of the Specifications unless otherwise noted on plans or specified hereinafter:

1. Electrical power wiring and appurtenances, Division 26.
2. Access panels in masonry, plaster, drywall, and acoustical tile, various Divisions.
3. Painting, Division 9.
4. Sheet metal downspouts and gutters, Division 5.
5. General Conditions, Division 01.
6. Louvers, Division 8.

1.9 DRAWINGS

A. Except where dimensions are shown, the mechanical (HVAC, plumbing and fire protection) drawings are diagrammatic and indicate the general arrangement of the systems and work included in the Contract. The drawings do not show every fitting and detail; all piping systems, duct systems and equipment installations are intended to be complete. The Contractor shall include in his bid and provide within the contract amount all necessary offsets, connections, supports, fittings, details, material and labor to complete the work as specified. Drawings are not to be scaled. The drawings and details shall be examined for building dimensions and exact location of fixtures and equipment. Where they are not definitely located, this information shall be obtained from the Architect.

B. The Contractor shall examine the drawings and thoroughly familiarize himself with conditions and space into which the work must be installed. Any areas of concern must be identified in writing to the Architect/Engineer within five (5) working days prior to the bid date.

C. Ignorance of work performed by other trades or conditions arising during the progress of the project shall not be considered as a basis for relieving the Contractor on a claim of not being able to properly estimate the entire cost of the work, nor shall it constitute grounds for non-performance of any portion of the work, nor shall it justify any increase in the contract amount.

D. The Contractor shall follow drawings in laying out work and coordinate with the drawings of other trades to verify spaces in which work will be installed. Contractor shall maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, the Contractor shall notify the Architect/Engineer and shall not proceed with this work until he has received supplemental instructions.

E. The Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check correctness of same as related to the work. Should the Contractor discover any discrepancy between actual measurements and those indicated which prevents following good practice or the intent of the Contract Documents, he shall notify the Architect/Engineer, and shall not proceed with this portion of the work until after he has received supplemental instructions.

F. All dimensions shown for duct sizes are net clear inside dimensions. Allowances shall be made for lined or double-walled ductwork.

G. Should the construction documents be provided to the contractor in electronic form as a platform for preparation of shop drawings, coordination, or other purposes, such files are provided strictly for the contractor's convenience. Architect/Engineer provide no warranty express, implied or otherwise, with such electronic documents and contractor assumes all risk associated with any use of such electronic files.

1.10 SPECIFICATIONS

A. There are intricacies of construction which are impractical to specify in detail, but in such matters the current rules of good practice shall govern. Any point which requires clarification will be fully explained if applications are made to the Owner's Representative. The Plans and Specifications are intended to be cooperative and of equal binding force.

B. Anything called for in the Specifications and not shown on the Drawings, or vice versa shall be furnished by this Contractor. (The best quality items for the intended purpose shall be installed).

1.11 NOISE LEVEL

A. All items of equipment shown on the Plans and described in the Specifications herein have been selected so that anticipated noise levels in the building from air conditioning and other system shall not be above NC level of 35 in the general occupied areas of the building.

B. If the Contractor wishes to make substitutions of equipment from that selected, he shall himself, satisfy the Architect, beyond any doubt, that the noise levels in the building will not exceed the above specified limits.

1.12 COST BREAKDOWN

A. The Contractor shall provide any cost breakdown that the Architect/Engineer may require for his accounting procedures, or to assist in analyzing bids, change order requests, application for payment, etc.

PART 2 - PRODUCTS

2.1 COORDINATION

A. The products of particular manufacturers have been used as the basis of design in preparation of these documents. Any modifications to the mechanical systems and their components, the electrical systems, the building structure and architecture, or any other portion of the building that result from the use of any other than the basis of design equipment shall be coordinated with all other trades. Such coordination shall occur before delivery of products from the manufacturer (before shop drawing submittals) and shall be clearly indicated on the shop drawings. All related modifications shall be borne by the Contractor and performed without any additional cost to the Contract.

B. The General Contractor shall include in his work the leaving of openings in the building roof, floors and walls for supply, return, exhaust air ducts and piping unless noted otherwise or specified

herein. It shall be the Mechanical Contractor's responsibility to ensure that all openings are left in the floors and partitions for the proper operation of the system and that all openings are in the correct locations.

C. Coordinate requirements of various components of the heating, ventilating and air conditioning system; fire protection system; and plumbing systems specified herein. Supervise interconnection and adjustment of these components so as to obtain a complete and functional system.

D. Coordinate work of this Division, including space requirements, with the work of other Divisions.

E. Work of this Division shall be carried on simultaneously with the work of other trades in a manner such as not to delay the overall progress of the work.

F. Materials and equipment shall fit into the space designated as indicated on the drawings without having to alter the building structure or any portion of the work to accommodate the installation.

1. Should space conditions be found to be inadequate, Contractor shall notify the Architect/Engineer and shall not proceed with this work until he has received supplemental instructions.
2. Where the Contractor has submitted product alternates to the Basis of Design, it shall be the Contractor’s responsibility to solve any issues with space constraints up to, and including alterations to the building structure with no added cost to the project.

G. Contractor shall not install any portion of the work until he has properly coordinated with all other trades to ensure proper clearance and fit as required for the installation of his work. Any material and/or equipment installed prior to coordination found to be in conflict with other trades shall be removed and/or corrected by the Contractor without addition to the contract amount.

H. Contractor shall coordinate all interfaces and connections with work specified in the Electrical Division and other sections. Contractor shall be aware of the requirements of these other Divisions and his responsibility at the interfaces and connections.

I. The electrical conduit and wiring for the motors, controllers, interlocks, control devices and controls are specified in Electrical Division, unless otherwise specified.

2.2 EQUIPMENT, MATERIALS, AND BID BASIS

A. It is the intention of these Specifications to indicate a standard of quality for all material and equipment incorporated in this work. Manufacturer’s names are used to designate the item of equipment or material as a means of establishing grade and quality. Where several manufacturers are named, only these manufacturers’ products will be considered and the Contractor’s bid shall be based on their products. Other named manufacturers, although acceptable as manufacturers, must prove their product will perform satisfactorily and will meet space requirements, and shall obtain pre-approval of their equipment, before submitting shop drawings. Any variances to any trade related to the substitution of any manufacturer’s equipment other than the basis of design shall be provided by the contractor with additional cost to the contract.

B. Where only one manufacturer is named, manufacturers of similar quality products will be considered unless the Specifications state otherwise. Such unnamed manufacturer’s products will, however, be considered as substitutions and shall not be used as a basis for bidding. In the event the Contractor wishes to submit substitutions to the Architect for review prior to bid, he shall furnish descriptive catalog material, test data, and samples, as well as any other pertinent

data necessary to demonstrate that the proposed substitutions are acceptable equals to the specified product. No substitutions shall be made without the written consent of the Architect and Engineer. No substitutions will be allowed after the project bid.

C. The use of one named manufacturer in the schedules on the Drawings is for guide purposes. The provisions of the previous paragraph will govern in the selection of products to be used.

2.3 SUBSTITUTIONS

A. Contractor shall list and identify all products, material and/or items other than those specified and/or shown on drawings, provided the substitution equals or exceeds the criteria for the item specified or shown on the drawings. Contractor shall assume responsibility for the installation of substitution so as not to make any portion of the work to be rendered inaccessible per manufacturers' recommendations. Contractor shall also assume responsibility to make certain that proposed substitution shall fit into space provided without altering, damaging, or having to demolish any portion of the work.

B. Prior approval is required where bidding Contractor intends to furnish a product other than those named in the specifications, or on the drawings, where product manufacturers are named.

C. Bidding Contractor shall submit request for prior approval in writing. Prior approval submittal shall contain listing of substitute item proposed for installation, specification section reference, proposed manufacturer, deviation (if any) from specified item, and any changes necessary to fit substituted item into the work. Failure to comply with the above shall be considered due cause for rejection.

D. Requests for prior approvals must be received no later than ten (10) working days prior to required date of notice of disposition.

E. Contractor shall not purchase any material and/or equipment prior to receiving verification of compliance with engineering design concept from Architect/Engineer. Any substitutions the Contractor wishes to propose in lieu of materials and/or equipment indicated in the contract documents shall be reviewed by the Architect/Engineer. Any material and/or equipment purchased and/or installed prior to the written confirmation of the review and approval by the Architect/Engineer found to be in non-compliance with the contract documents shall be corrected as instructed by the Architect/Engineer without addition to the contract amount.

F. Contractor shall not make any changes in design as shown on the drawings or as described in the specifications without written permission from the Architect/Engineer. Any changes the Contractor wishes to propose to the design indicated in the contract documents shall be reviewed by the Architect/Engineer. Changes in the design shall be allowed only by approval from the Architect/Engineer. Any changes in design not approved by the Architect/Engineer shall be the sole responsibility and liability of the Contractor. Any problematic conditions arising from design changes by the Contractor shall be corrected by the Contractor at no cost to either the Owner or the Architect/Engineer.

2.4 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS

A. Materials and adhesives used throughout the mechanical and electrical systems for insulation, and jackets or coverings of any kind, or for piping or conduit system components, shall have a flame spread rating not over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flamespread

rating not over 25 and a smoke developed rating not higher than 50. (Note: Materials need not meet these requirements where they are entirely located outside of a building and do not penetrate a wall or roof, and do not create an exposure hazard.)

B. “Flame-Spread Rating” and “Smoke Developed Rating” shall be as determined by the “Method of Test of Surface Burning Characteristics of Building Materials,” NFPA No.255, ASTM E84, Underwriter’s Laboratories, Inc., Standards. Such materials are listed in the Underwriters’ Laboratories, Inc., “Building Materials List” under the heading “Hazard Classification (Fire)”.

2.5 HAZARDOUS MATERIALS

A. No products shall be used that contain any known hazardous or carcinogenic materials.

B. No materials containing asbestos or radioactive contents shall be provided and/or installed.

C. Handling of any hazardous material is not covered in this Specification Division. Any requirements for such are beyond the scope of this Contract and shall be done only by those persons contracted to do so.

PART 3 – EXECUTION

3.1 GENERAL

A. The mechanical (HVAC and plumbing) and fire protection (performance based specifications) Contract Documents do not give exact elevations or locations of lines, nor do they show all the offsets, control lines, or other installation details. The Contractor shall carefully lay out his work at the site to conform to the structural conditions, to provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and to thereby provide an integrated, coordinated and satisfactory operating installation. If the Contractor proposes to install equipment, including piping and ductwork, requiring space conditions other than those shown or should local conditions necessitate a rearrangement of piping and/or ductwork, or to rearrange the equipment, he shall assume full responsibility for the rearrangement of the space and shall have the Owner's Representative review the change before proceeding with the work. This shall be performed at no additional cost to the Owner or Architect/Engineer. The request for such changes shall be accomplished by Contractor prepared Shop Drawings of the space or items in question. The Owner or Owner's Representative reserves the right to reject any equipment which, in his opinion, does not fit the space.

B. If the Contractor proposes to install equipment, including piping and ductwork, requiring space conditions other than those shown, or to rearrange the equipment, he shall assume full responsibility for the rearrangement of the space and shall have the Architect review the change before proceeding with the work. The request for such changes shall be accompanied by Shop Drawings of the space in question. All related costs incurred shall be borne by the Contractor and performed without any additional cost to the contract.

C. The Contractor is responsible for the proper location and size of all slots, holes or openings in the building structure pertaining to his work, and for the correct location of sleeves, inserts and cores. Coordinate all openings required through building structure to avoid conflicts with other work and trades.

D. The Contractor shall coordinate his portion of the work with the work of the other trades so that it may be installed in the most direct, efficient, and workmanlike manner without hindering or otherwise restricting the other trades. Piping interferences shall be handled by giving precedence to pipe lines which require a specific grade for proper operation. Storm drainage or sewer lines and condensate piping shall take precedence over water and refrigerant lines in determination of elevations. Where there is interference between storm drainage or sanitary waste and vent lines and condensate lines, the storm drainage or sanitary waste and vent lines shall have precedence and provisions shall be made in the condensate lines for routing them around the storm drainage or sanitary waste and vent lines. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.

E. All piping and ductwork in finished areas, shall be installed in chases, furred spaces, or above ceilings. Pipes and ducts shall be installed as high as possible. Valves in piping systems shall be offset down to within one (1) foot of access point. Runs of piping shall be grouped whenever it is feasible to do so.

F. Piping, equipment, or ductwork shall not be installed in electrical equipment rooms, elevator machine rooms or computer rooms unless specifically serving those rooms only. When necessary to install piping, ductwork, or locate equipment in electrical equipment rooms, it shall not be installed closer than 42" in front (and rear if free standing) of electrical equipment; or closer than 36” of sides of electrical equipment. These clearances shall apply vertically from floor to structure.

G. Locate required valves and dampers in areas accessible for maintenance. No access panels shall be permitted in public spaces unless specifically indicated on the Contract Documents.

H. Provide access to equipment and apparatus requiring operation, service or maintenance within the life of the system. Devices include, but are not limited to: motors, valves, filters, dampers, and shock absorbers. Equipment located above lay-in type ceilings is considered accessible. Access shall be as recommended by the equipment manufacturer and as required by code.

3.2 COORDINATION DRAWINGS

A. Prepare and submit for review coordination fabrication drawings as required to a scale of 1/8"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations (dimensioned from major building components and column lines including bottom elevations of installed MEPFP components and systems) of piping (all divisions), ductwork, equipment, conduit and materials with dimensions from structural components and elevations of suspended items. Include the following:
    a. Clearances for installing and maintaining insulation.
    b. Clearances for servicing and maintaining equipment, including code required clearances for equipment with electrical components, filter removal, and space for equipment disassembly required for periodic maintenance.
    c. Equipment connections and support details.
    d. Exterior wall and foundation penetrations.
    e. Fire-rated and smoke rated wall and fire rated floor penetrations.
    f. Sizes and location of required concrete pads and bases.
    g. Valve stem movement.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, and other ceiling-mounted items.

3.3 COOPERATION WITH WORK UNDER OTHER DIVISIONS

A. It is the sole responsibility of the Contractor for the completeness of his work and for giving timely and adequate information to other Contractors where required for proper routing and support thereof.

B. Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Layout work carefully at the site to conform to the building and site conditions to avoid all obstructions. Coordinate work with that of the other trades to avoid delays and expense to others.
3. Failure to route pipes and/or ducts through the building without interfering with other Contractor's equipment or construction, shall not constitute a reason for an extra charge. Check Architectural and Structural drawings and details for interferences as governed by structural or other conditions before installing work. The right is reserved to make any reasonable change in location of the various pieces of equipment, ducts, piping and mechanical systems shown on drawings prior to roughing in at no additional cost to the Contract, Owner, or Architect/Engineer.
4. Verify all dimensions by field measurements.
5. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
6. 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.
7. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building. Schedule work to permit inspections by the Owner's Representative and/or authorities having jurisdiction, as required, before the work is completed.
8. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
9. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
10. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Owner's Representative.
11. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
12. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting,

with minimum interference with other installations. Extend grease fittings to an accessible location.

13. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors shall be of adequate size for maintenance purposes and be as follows:
    a. Furnish and install access doors at each point required to provide access to concealed valves, cleanouts, fire dampers and other devices requiring operation, adjustment, or maintenance. Access doors shall be 16 gauge steel, prime coat finish, with mounting straps, concealed hinges and screwdriver locks, designed for the doors to open 180 degrees.
    b. Access doors installed in fire walls or partitions shall be U.L. labeled to maintain the fire rating of the wall or partition.
14. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

C. Cooperate with all other trades to facilitate the general progress of the work. Allow all other trades every reasonable opportunity for the installation of their work and the storage of their materials.

D. The work under this Division shall follow the general building construction closely. Set all pipe sleeves, inserts, etc. and ensure that all openings for chases, pipes, etc., are provided before concrete is placed or masonry is installed.

E. Work with other trades in determining exact locations of outlets, conduits, fixtures and pieces of equipment to avoid interferences with lines as required to maintain proper installation of other work.

F. Make such progress in work that will not delay the work of other trades. Schedule the work so that completion dates as established are met. Furnish sufficient labor or work overtime to accomplish these requirements.

3.4 GENERAL INSTALLATION REQUIREMENTS

A. No portion of the work requiring submittals and/or shop drawings shall be commenced until submission has been reviewed and found to be in compliance with the design concept by the Architect/Engineer. All work, material and equipment shall be in compliance with the submittals and/or shop drawings.

B. All equipment shall be installed in strict conformance with the manufacturer’s most current recommendations, as specified in this Division, and as shown on the drawings. If any conflict arises between these instructions, notify the Architect/Engineer immediately for guidance.

C. Contractor shall install all material and equipment at locations indicated on the drawings. Contractor shall verify adequacy of space conditions at building before commencing work. All materials and equipment shall be installed so as to maintain maximum headroom and access to equipment, control devices, valves and dampers.

D. Installation of any work contrary to the applicable Codes, Laws, Ordinances, Rules, Regulations or Contract Documents without written notice to and review from the Architect shall result in the Contractor bearing all costs arising therefrom to correct such work.

E. Except where specifically noted, the plans do not give exact elevations or locations. Thoroughly examine the details of the proposed construction, including exact elevations, locations of necessary points of connection, and obstructions by using visits to the site prior to the bidding. Lack of knowledge of the existing conditions shall not increase the contract sum.

F. Provide access to equipment and apparatus requiring operation, service or maintenance within the life of the system. Including, but not limited to, motors, valves, filters, dampers, shock absorbers, etc. Equipment located above lay-in type ceilings is considered accessible.

G. Subject to the Architect/Engineer's approval, make minor deviations from the plans where required by space limitations at no addition to the Contract price. Make no alterations to orientation or arrangement of equipment as shown on design drawings, due to unusual and unforeseen circumstances, without prior written approval from the Architect/Engineer.

H. Furnish all necessary anchor bolts which have not been provided with equipment. Where anchor bolts are not built into structure, through bolts or other means approved by the Architect/Engineer are permissible. When necessary to drill concrete floors or foundations, secure anchor bolts in place with approved materials and methods of attachment.

I. Prior to setting equipment on foundations, confirm that foundations present true surface for solid bearings of equipment supports.

J. Dimensions, connections and installation details of the equipment supplied by different acceptable manufacturers may vary. Provide shop drawings, services, materials and labor necessary for compliance with requirements of plans and specifications.

K. Supply information on actual equipment to be installed to other trades whose work will be affected.

1. All opening sizes and supplemental support steel required for all items furnished and/or installed under Mechanical Division.
2. Weights and locations of attachment of all equipment supported from the building structure.

L. Where penetrations occur through the roof, the Contractor shall furnish and install all necessary roof curbs, flashings, and any other materials necessary to provide a proper installation of the mechanical portion of the work.

M. Employ proper crafts to install and test all equipment; installer shall assume responsibility for proper alignment, cleaning and lubrication of such equipment prior to start-up. All personnel employed, and their assigned responsibilities in execution of this work, shall be maintained in harmony with those of other work trades at site, to avoid disputes and delays to the overall construction schedule.

N. Complete installations are required. Coordinate work with others responsible for other services to and from equipment so that installations may be turned over to Owner fully tested and ready for operation.

O. Exercise reasonable care at all times to protect equipment and building from damage.

P. The air systems shall operate without aerodynamic noise being generated from the faulty installation of ductwork or any component of the air distribution system.

Q. Do not tap couplings on shafts if bearings or other parts are mounted thereon. Use proper wheel puller to remove coupling hubs if removal is necessary.

R. Cooperate with and render any required assistance to equipment manufacturer's service engineers or erection supervisors who have been engaged to supervise erection, inspect installations, and make necessary adjustments to place equipment in proper operating condition prior to start-up.

S. If equipment or parts thereof when received for installation are found to be damaged in any manner, or fail to comply with the manufacturer's certified prints, immediately advise the Architect/Engineer so that proper corrective measures may be taken.

T. Whenever possible, check all driven machines for free turning by hand, before mounting. Do not operate equipment by electrical power unless properly lubricated.

U. When no specific instructions for testing are included in Specifications for Equipment, test each item, after installation, in accordance with manufacturer's printed instructions.

V. Provide all roughing, traps, tail pieces, fittings, adapters and other connecting piping, and make final water supply and drain connections to plumbing, fixtures, mechanical equipment, food service and vending equipment.

3.5 WORKMANSHIP

A. All work shall be performed in the best and most workmanlike manner by mechanics skilled in their respective trades and properly licensed. All equipment shall be installed in accordance with the recommendations of the manufacturer and standard practice in the Atlanta high-rise residential market.

B. All welders employed for this work shall be certified under the standard procedure specifications of the National Certified Pipe Welding Bureau. Evidence of welder's qualifications shall be submitted to the Architect/Engineer before any welds are made.

3.6 SITE OBSERVATIONS

A. Contractor shall notify Architect/Engineer and Commissioning Agent a minimum of 5 working days in advance of various tests and site observations that are required as specified elsewhere in these specifications.

B. No portion of the work shall be concealed until site observations have been made.

3.7 PROTECTION OF EXISTING UTILITIES

A. The Contractor shall use extreme caution during excavation operations not to damage or otherwise interrupt the operations of existing utilities. The Contractor shall be responsible for the continuous operation of these lines and shall provide bypasses or install shoring, bracing, or underpinning as may be required for proper protection.

B. Locations and elevations, together with method of tie-in of utilities as indicated by the Plans and Specifications, have been obtained by conferences with the Utility Companies or other reliable sources and are shown as a guide without guarantee as to accuracy.

C. Examine the site, confer with the Utility Companies, and verify the requirements for connections.

D. Pay all necessary connection costs. Failure to include such costs shall not relieve the Contractor of the responsibility or be used as a basis for additional compensation.

E. Verify the depth of existing sanitary sewer at the point of connection before proceeding with any work. Should sewer depth at the point of connection be too high for proper drainage, Contractor

shall request instructions from the Architect/Engineer.

F. Schedule work so existing systems operation will not be interrupted. Obtain approval from the Owner at least seven (7) days prior to any utility interruption or connection.

G. Coordinate all activities around existing utility lines with the appropriate utility company.

3.8 ELECTRICAL WORK

A. All electrical equipment provided under this Division shall comply with the electrical system characteristics indicated on the Electrical Drawings and specified in Electrical Division.

B. HVAC equipment motor speed controls, system controls, and pilot lights and push buttons, shall be furnished complete as a part of the motor apparatus which it operates. All components shall be in conformance with the requirements of the National Electrical Code and Electrical Division. Motor starters for all other equipment shall be furnished under Electrical Division.

C. All power wiring and final power connections to the system shall be provided under Electrical Division.

D. Control wiring shall be provided under Mechanical Division. Provide all required 120 volt to 24 volt transformers as required for a complete functional system installed by the Contractor and properly coordinated in the field prior to installation. Extend wiring for transformers from the nearest 120 volt power circuits located near the controlled mechanical devices; connect at circuit junction boxes, and as required by Code. All wiring for voltages higher than 30 volts shall be done by a licensed electrician.

E. All electrical characteristics for mechanical equipment shall be taken from the Electrical Drawings and Specifications and coordinated with the Electrical Contract Documents before equipment is ordered or shop drawings are submitted. Contractor shall submit written letter stating all equipment requiring power has been coordinated with the electrical contractor with a list of this equipment indicated and its associated electrical requirements.

3.9 INSERTS, BLOCK-OUTS, PIPE SLEEVES, AND FIRE CAULKING

A. Refer to Section 23 05 29 for inserts.

B. The Contractor shall install, as required, in concrete, carpentry or masonry construction, all necessary hangers, sleeves, expansion bolts, inserts and other fixtures and appurtenances necessary for the support of all pipe, duct, equipment and devices furnished under each section of the Specification.

C. Cutting of openings, and installation of sleeves or frames through walls and surfaces shall be done in a neat workmanlike manner. Openings shall be cut only as large as required for the installation (i.e. pipe and pipe insulation as applicable). Sleeves, except as otherwise indicated, and/or frames shall be installed flush with finished surfaces and grouted in place. Surfaces around openings shall be left smooth and finished to match surrounding surface.

D. Pipes passing through concrete and masonry walls and partitions and through concrete floor shall be provided with pipe sleeves which shall be installed during construction of walls, partitions and floors. All pipe sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors and roof are constructed.

1. Sleeves are not required for water and waste connections through a wall or partition to an individual fixture.
2. Sleeves are not required for cast-iron pipe through concrete slab on grade
3. Sleeves shall not be installed in structural members of work, except as detailed on structural drawings, or as reviewed by Structural Engineer.

E. Install sleeves accurately centered on pipe runs so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion. Where insulation includes vapor barrier jacket, provide sleeve with sufficient clearance for installation.

F. Sleeve materials shall be as follows:

1. In walls below grade: Schedule 40 black steel pipe, ASTM A120, or A-53.
2. In concrete or masonry walls above grade: Schedule 40 black steel pipe, ASTM A120, or A-53.
3. In fire and smoke rated walls and partitions above grade: Schedule 40 black steel pipe, ASTM A120, or A-53. At contractor's option, U.L. listed sleeve assemblies for piping penetrations are acceptable.
4. In non-rated walls and partitions above grade: 18-gauge galvanized sheet steel with lock-type longitudinal seams.
5. In concrete floors above grade: Schedule 40 black steel pipe, ASTM A120, or A-53.
6. In concrete roof slabs: Schedule 40 black steel pipe, ASTM A120, or A-53.

G. Sleeve sizes shall be as follows:

1. In walls below grade: Sleeve size shall be such as to provide an annular space per published installation instructions of mechanical sleeve manufacturer between the sleeve and the passing pipe.
2. In concrete or masonry walls above grade: Sleeve size shall be such as to provide an annular space of 1/2" to 1" between the sleeve and the passing pipe or pipe insulation.
3. In fire rated walls above grade: Sleeve size shall be such as to provide an annular space between the sleeve and the passing pipe required as per fire caulk manufacturer's published installation instructions.
4. In non-rated walls and partitions above grade: Sleeve size shall be such as to provide an annular space of 1/2" to 1" between the sleeve and the passing pipe or pipe insulation.
5. In concrete floors above grade: Sleeve size shall be such as to provide an annular space between the sleeve and the passing pipe required as per fire caulk manufacturer's published installation instructions.
6. In concrete roof slabs: Sleeve size shall be such as to provide an annular space between the sleeve and the passing pipe required as per fire caulk manufacturer's published installation instructions.

H. Sleeve lengths shall be as follows:

1. In walls below grade: Where pipes pass exterior walls shall be steel pipe, flush with the exterior surfaces, and with the space between the pipe and the sleeves caulked watertight in an approved manner.
2. In concrete or masonry walls above grade: Where pipes pass through masonry walls, sleeve ends shall be flush with wall surfaces.
3. In fire rated walls and partitions above grade: Where pipes pass through fire rated, sleeve ends shall be flush with wall surfaces. Each pipe passing through fire rated walls or floors requiring fire caulking shall be installed with clearances required as per fire caulk manufacturer's published installation instructions.
4. In non-rated walls and partitions above grade: Where pipes pass through fire rated walls and partitions, sleeve ends shall be flush with wall surfaces.

5. In concrete floors above grade: Where pipes pass through floor slabs, sleeves cut flush with the underside of the floor and shall extend one (1") inch above finished floor. Each pipe passing through fire rated walls or floors requiring fire caulking shall be installed with clearances required as per fire caulk manufacturer's published installation instructions
6. In concrete roof slabs: Where pipes pass through roof slabs, sleeves cut flush with both sides of the slab. Each pipe passing through fire rated walls or floors requiring fire caulking shall be installed with clearances required as per fire caulk manufacturer's published installation instructions

I. Sleeve sealing shall be as follows:

1. In walls below grade (mechanical sleeve seals): Loosely assembly rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal. Seal entire exterior surface of exterior side of mechanical sleeve seals with silicone caulking to ensure a completely watertight penetration of exterior walls.
2. In fire rated walls and partitions above grade: Each pipe passing through fire rated walls or floors requiring fire caulking shall be installed with clearances required as per fire caulk manufacturer's published installation instructions.
3. In concrete or masonry walls above grade: See additional project specifications and/or refer to drawing details.
4. In non-rated walls and partitions above grade: See additional project specifications and/or refer to drawing details.
5. In concrete floors above grade: Each pipe passing through fire rated walls or floors requiring fire caulking shall be installed with clearances required as per fire caulk manufacturer's published installation instructions.
6. General: Each pipe passing through fire rated walls or floors requiring fire caulking shall be installed with clearances required as per fire caulk manufacturer's published installation instructions.

J. Where exposed piping, bare and insulated, passes through floors, walls and ceiling, except in Mechanical Rooms, escutcheons shall be provided. Escutcheons shall be chrome-plated steel plates, hinged type with set screw. Escutcheons shall be as manufactured by Bea-Cor, F&S or Grinnell. Escutcheons for chrome plated connections at plumbing fixtures shall be as specified under the plumbing fixtures.

K. All pipe penetrations shall be sealed in accordance with the details shown on Drawings and/or noted in these Specifications.

L. Insulated piping passing through fire-rated walls or floors must have the pipe insulation interrupted on both sides of the fire-rated wall/floor penetrations.

M. Where pipes pass under load bearing footings they shall pass through a coated steel pipe sleeve two pipe sizes larger than the pipe in service as described above and extend past a 45° line out from the bottom of the load bearing structure. Concrete shall be used as backfill in the portions of trench within the 45° pressure line.

N. Pipes passing through any parts of the structure subject to settling or the shifting over time shall be sleeved in a manner to allow for such settling or shifting without damage to the pipes.

3.10 FIRE STOPPING

A. Subject to compliance with requirements and Code, products that may be used include, but are not limited to, the following, to seal all penetrations through rated assemblies:

1. “Dow Corning Fire Stop Foam” as manufactured by Dow Corning Corp.
2. “Pensil 851" as manufactured by General Electric Co.
3. “Dow Corning Fire Stop Sealant” as manufactured by Dow Corning Corp.
4. “3M Fire Barrier Caulk CP-25" as manufactured by 3M/Electrical Products Division.
5. “RTV 7403" as manufactured by General Electric Co.
6. “Fyre Putty” as manufactured by Standard Oil Engineered Materials Co.

B. Provide two-part, foamed in place, fire-stopping silicone sealant formulated for use in a through penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E-814 by Underwriters Laboratory, Inc. Or other testing and inspecting agency acceptable to local authorities having jurisdiction.

C. Provide one-part, elastomeric sealant formulated for use in a through penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E-814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to local authorities having jurisdiction.

3.11 CUTTING AND PATCHING

A. The Contractor shall assume all cost of, and be responsible for, arranging for all cutting and patching required to complete the installation of his portion of the Work. All cutting shall be carefully and neatly done so as not to damage or cut away more than is necessary of any existing portions of the structure.

B. During cutting and patching operations, protect adjacent installations.

C. Perform cutting, fitting, and patching of mechanical equipment and materials as 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. Install equipment and materials in existing structures.
6. Upon written instructions from the Owner's Representative, uncover and restore Work to provide for Owner's Representative observation of concealed Work at no additional cost to the Contract.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

G. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

H. The Contractor shall make suitable provisions for adequately water-proofing at his floor

penetrations of water proof membrane floors. This shall include but not be limited to floor drains, floor sinks, open sight drains, hub drains, cleanouts, and sleeves for the various piping systems. This requirement also applies to membrane roofing systems.

3.12 LOCATIONS OF EQUIPMENT, FIXTURES AND ROUGH-INS

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications and submittals for rough-in requirements.

C. The plans indicate approximate location of items which the Contractor is to install.

D. Confirmed locations shall include, but are not to be confined to, the following:

1. Grilles, registers and diffusers; operating switches and starters; plumbing fixtures and floor drains; rough-ins for future equipment and/or equipment being furnished by the Owner; all equipment or appliances being furnished by others.

E. Where equipment is being furnished by another Contractor and connected by this Contractor, this Contractor shall request of the Contractor or Owner a reviewed Drawing showing exact dimensions of required locations of services and this Contractor shall install the required facilities to the exact requirements of the reviewed Drawing furnished.

F. Installation and Connection of Equipment:

1. Where indicated by the Plans and Specifications, Contractor shall install and/or connect equipment furnished by other Contractors or the Owner.
2. Such items shall be supplied to this Contractor during the progress of the construction and at such times as will not reasonably interfere with the progress of this Contractor. Schedule for such work sufficiently in advance to permit supply of the items to schedule the requirements.
3. The Owner and Owner's Representatives' decisions shall be binding as to whether or not the Contractor is entitled to extra compensation due to delays caused by failure of delivery of items to meet the schedule the Contractor has furnished the Owner for his work.
4. At the time for final acceptance of this Contractor's work, should any items concerned remain incomplete, due to failure of others to supply same, this Contractor shall issue a credit for the work not performed in amounts satisfactory to the Owner or Owner's Representative or else enter into an agreement with the Owner for completion of the work at a future date.
5. Where installation is incomplete, the Contractor shall provide cap-off plate covers of other items as directed by the Owner's Representative to leave the services ready for future connection and to place the system in acceptable condition for future use.

G. Contractor shall notify the Architect of his requirements for confirmed locations a reasonable time in advance of construction to permit obtaining such data.

H. Failure of the Contractor to perform as described above shall make him responsible for costs or changes required to conform to the requirements.

3.13 EQUIPMENT FURNISHED BY OWNER OR OTHER CONTRACTORS

A. The Contractor shall unload, uncrate, assemble, and make final connection to any and all

equipment shown on the Drawings or called out in the Specifications to be furnished by the Owner for installation by the Contractor.

B. The Contractor shall take full charge of such equipment from the time the items are delivered to the job. He shall be responsible for such items until they are set in place, connected, tested, adjusted, and placed into operation as if he were the original purchaser.

3.14 PROTECTION OF THE EQUIPMENT

A. Store all equipment, including pipe and valves, off the ground and under cover. For storage outdoors, minimum four (4) mil thick plastic shall be securely fitted to withstand splattering, ground water, precipitation and wind.

B. Protect rooftop and fan coil units coil by use of protective sheet metal panels, 4 mil thick plastic, or plywood for an airtight seal. All fans shall be shrink wrapped with thick plastic to prevent dirt and debris from entering the equipment and associated ductwork.

C. Protect top of air units from damage by other trades during construction with plywood covering.

E. Plug ends of pipe when work is stopped each day and close ends of ducts each day and cover until work resumes with the next installation activity; cover all air distribution devices involved with the supply, return, exhaust, transfer, outside air systems in the HVAC ductwork system with four (4) mil thick plastic taped in place until Test and Balance work is performed. Duct tape shall not be considered an acceptable substitute.

E. Damaged equipment shall be repaired or replaced as directed by the Architect/Engineer.

F. Handle all equipment and components carefully to prevent damage, breaking, denting, scoring, etc. Do not install damaged equipment and components, replace with new. Comply with the manufacturer's rigging and installation instructions for unloading all equipment and components and moving them to and from storage areas to their final locations. The Contractor shall be responsible for providing this care for all equipment and components specified in Mechanical Division.

3.15 ELECTRICAL EQUIPMENT ROOM PRECAUTIONS

A. No ductwork and/or piping shall be installed in any switchgear room, transformer vault, telephone room, or electrical closet.

B. In Mechanical Rooms, where piping runs over motor control centers or other electrical equipment, a suitable sheet metal drip pan shall be provided. Shop drawings shall be submitted showing proposed shielding at each location.

C. Piping, equipment, or ductwork shall not be installed in electrical equipment rooms except as serving only those rooms. Outside of electrical equipment rooms, do not run piping or ductwork, or locate equipment, with respect to switchboards, panelboards, power panels, motor control centers, or dry type transformers:

1. Within 42" in front (and rear if free standing) of electrical equipment; or within 36" of sides of equipment. Clearances apply vertically from floor to structure. Where these clearances for mechanical and plumbing piping installation are unavailable due to space constraints, provide galvanized steel drain pans below piping of sufficient width (8" min.) and depth (8"

min.) to protect the electrical equipment from any leakage that could develop. Provide a minimum 1" drain line from the pans to the nearest floor drain.

3.16 FREEZE PROTECTION

A. During the process of construction, the Contractor shall make certain that no portion of the work is subject to damage by freezing. The Contractor shall take all necessary steps, such as temporary heat, heat tape, draining of systems, or other means of freeze prevention to prevent any damage. The Contractor shall not use any anti-freeze solution on potable water systems or on systems in which back-siphonage into the potable water system is possible. Any damages resulting from freezing shall be repaired by the Contractor at his own expense.

3.17 PAINTING

A. Factory painted equipment that has been scratched or marred shall be repainted with Industrial grade paint to match original factory color.

B. All uninsulated black ferrous metal items exposed to sight inside the building, such as piping, equipment hangers and supports not provided with factory prime coat, shall be cleaned and painted with one coat of zinc chromate primer. In addition, such items in finished spaces shall also be painted with two coats of finish paint in a color to match adjacent surfaces or as otherwise selected by the Architect.

C. Black ferrous metal items exposed outside the building, such as support beams, pipe supports, piping, with or without factory prime coat, shall be cleaned and painted with one coat of rust inhibiting primer and two coats of an asphaltic base aluminum or rust inhibiting paint. Insulated ferrous pipes outside the building shall be cleaned and painted with one coat of rust inhibiting primer before installing insulation.

D. Insulated ferrous pipes located inside the building that will convey liquids with temperatures below 70˚ F shall be cleaned and painted with one coat of rust inhibiting primer before installing insulation.

E. In lieu of painting hanger and supports of all systems, cadmium plated or galvanized hangers and supports may be furnished, otherwise provide one coat of asphaltum varnish or rust inhibiting paint to all hangers and supports.

F. No nameplates or equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation.

G. Galvanizing broken during construction shall be recoated with cold galvanizing compound.

H. All ductwork, piping, insulation, conduit or other appurtenances visible through grilles and diffusers shall be painted flat black.

I. All underground ferrous pipes shall be given a liberal coat of acid resisting paint having a bituminous base before backfilling.

J. All ferrous uninsulated lines in concealed spaces shall be given two coats of black asphaltum varnish.

K. Provide two (2) coats of white waterproof mastic on all refrigerant piping insulation exposed outside the building.

3.18 BELT DRIVES

A. V-belt drives shall be rated at not less than 150% of nominal horsepower.

B. Motor sheaves shall be variable pitch type.

C. Scheduled fan static pressures are estimated. Provide and adjust drives to deliver air quantities against actual system resistance.

D. Do not force V-belts over sheaves during installation.

E. Provide guards for all belt drives not enclosed within equipment housings. Belt guards for fans shall be expanded metal with heavy gauge sheet metal sides. Provide opening in guards at driving and driven sheaves for use of tachometer for revolution measurement.

3.19 ACCESS DOORS AND ACCESS PANELS

A. Furnish and install access doors of adequate size for maintenance purposes at each point required to provide access to concealed valves, cleanouts, fire dampers and other devices requiring operation, adjustment, or maintenance. Access doors shall be 16 gauge steel, prime coat finish, with mounting straps, concealed hinges and screwdriver locks, designed for the doors to open 180 degrees.

B. Access doors installed in fire walls or partitions shall be U.L. Labeled to maintain the fire rating of the wall or partition.

3.20 ESCUTCHEONS

A. Escutcheons shall be installed on all insulated or bare pipes where they pass through floors, ceilings, walls or partitions in finished areas.

B. The interior of closets, adjacent to finished areas, shall be considered as finished for the intent of these Specifications.

C. Escutcheons shall be split, hinged, stamped brass type designed to fit the bare or insulated pipe, and to cover the terminating pipe sleeve, in chrome plated finish unless otherwise specified, with securing device to hold the escutcheon tight to the bare or insulated pipe.

D. Sufficient spacing between parallel pipe runs shall be allowed to insure installation of escutcheons without modification. The escutcheons shall not be altered in any manner to allow for installation.

3.21 CLEANING

A. During the process of construction, the Contractor shall keep all pipe openings closed by using temporary plugs or caps to prevent foreign matter, dust and construction debris from entering. The Contractor shall cover all openings in ducts with suitable material to prevent foreign matter, dust and construction debris from entering. The Contractor shall cover all fixtures, equipment, air distribution devices, and apparatus as required to protect them against dirt, water, chemical or mechanical damage, both before and after installation for the construction phase until such items are ready to place in use for testing purposes. Any such fixtures, equipment or apparatus

damaged prior to final acceptance of the work shall be restored to its original condition or replaced.

B. Temporary filters (min. MERV-4 rated) shall be provided for all project equipment that is operated during construction. This includes, but is not limited to: fans, air handling units, fan coil units, rooftop units, energy recovery ventilators, dedicated outdoor air systems, make-up air units, etc. Temporary filters shall be changed regularly every week or sooner as required to prevent contamination of the equipment and duct systems. At the time of starting the balancing of the air distribution system, new filters shall be installed. Permanent filters (new and unused) shall be installed one (1) week prior to final site observation or final certificate of occupancy, whichever occurs latest.

C. Air Handling and Fan Coil Units: Do not operate air handling units without (min. MERV-4 rated) filters in place, or prior to acceptance without receipt of written permission from the Architect/Engineer based upon field verification.

D. Any fans or air units operated during construction shall have temporary (min. MERV-4 rated) filters. Filters shall be changed weekly or sooner as required.

E. Ends of open ducts and pipes shall be covered during construction except when working directly on such end prohibits covering. Cover with minimum four (4) mil thick polyethylene taped, tied or wired in place.

F. The interior of ducts, plenums, air moving equipment, and equipment casings shall be cleaned of all debris and blown free of all particles of rubbish and dust before installing outlet faces. Any ductwork and air distribution devices that become contaminated with dust, debris, chemicals or moisture shall be thoroughly cleaned and a written report submitted to the Architect/Engineer and of the actions taken and date of completion. Materials that cannot be properly cleaned shall be replaced at the contractor’s expense. Any duct or pipe insulation that becomes wet during construction shall be removed and replaced at the Contractor’s expense.

G. The exterior surfaces of all mechanical equipment, piping, and ducts, shall be cleaned of all grease, oil, paint, dust and other construction debris.

H. All equipment, pipe, valves and fittings shall be cleaned of grease, oil, paint spots, metal cuttings, sludge, and construction debris.

I. Bearings in equipment that require lubrication shall be lubricated in accordance with the manufacturer's recommendations. Submit written certification of the completion of the lubrication indicating each piece of equipment for which the lubrication was performed. A list of the manufacturer's lubrication schedule shall also be included.

J. Sterilize the domestic water supply and distribution system in accordance with the local codes having jurisdiction. Furnish three (3) copies of a Certificate of Performance of Complete Sterilization to the Architect before final site observation of the work, all work shall be certified by a State approved testing laboratory.

K. After the hydrostatic tests have been made and prior to the operating tests, equipment shall be thoroughly and effectively cleaned of foreign materials. Wherever possible, water-contacted surfaces shall be wire-brushed to remove loose material. The equipment shall then be cleaned as recommended by the equipment manufacturer.

L. Remove all stickers, rust, stains, unnecessary labels, grease, and temporary covers before final acceptance.

M. Clean and polish all equipment identification plates.

N. Equipment rooms shall be left broom clean.

3.22 TESTING

A. During the progress of the work, or upon its completion, the Contractor shall, at his own expense, make such tests of his work as herein specified or as required by the Owner and/or Architect/Engineer. He shall provide all apparatus, temporary piping connection or other requirements necessary for such tests and shall take all due precautions to prevent damage to the building or its contents incurred by such tests. Contractor shall furnish a certified report of compliance or noncompliance on each test to the Architect/Engineer.

3.23 AS-BUILT DRAWINGS

A. The Contractor shall maintain on a daily basis at the project site a complete set of contract mechanical, plumbing and fire protection “As-Built Drawings”, reflecting an accurate dimensional record of all new (and existing) buried or concealed work from multiple column lines. The “As-Built Drawings” shall be marked to show the precise location of concealed work and equipment, including concealed or embedded piping and valves and all changes and deviations in the Mechanical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite instructions from the Architect. The completed set of marked-up drawings, clearly showing the nature and extent of all changes, shall be turned over to the Architect upon completion and acceptance of the work.

B, The “As-Built Drawings” shall consist two (2) record copies, including one (1) set of mylar sepia prints and one (1) electronic set, of the Contract Drawings for this Division with the Engineer’s seal and Engineer’s firm name removed or blacked out. Prior to commencing work the Contractor shall obtain from the Architect a full set of the latest construction CAD paper plots to be used for the “As-Built Drawings” mark-ups.

C. Record dimensions shall clearly and accurately delineate the work as installed; locations shall be suitable identified by at least two (2) dimensions to structural column lines or a permanent structure.

D. The Contractor shall mark all “As-Built Drawings” on the front lower right hand corner with a rubber stamp impression that states the following:

1.	“AS-BUILT DRAWINGS”	(3/8" high letters)
2.	To be used for recording Field Deviations and Dimensional Data Only.	(5/16" high letters)

E. Maintain sheet metal shop drawings and piping shop drawings to reflect changes necessary to correct unforeseen field conditions as they arise. The Contractor shall make certain these changes have been made to shop drawings and construction drawings, and turn two (2) sets over to the Owner, upon completion and acceptance of the work, including one (1) set of mylar sepia prints and one (1) electronic set. Furnish two (2) additional sets of mark ups of the as-built conditions, on the latest contract documents, to the Owner or Architect/Engineer, upon completion and acceptance of the work.

3.24 RECORDS AND INSTRUCTIONS FOR OWNER

A. Provide manuals as required for Operating and Maintenance Data. Use multiple binders if a single binder would exceed 3 inches in thickness; arrange the data in the same sequence as the specification sections; delete or mark through extraneous data. Furnish 4 copies of manuals. Turn over to the Architect/Engineer for check and subsequent delivery to the Owner.

B. Provide tab pages with metal or plastic reinforced holes to separate each major item or closely related group of items with typed item names on the tabs. Supply a table of contents at the beginning of each volume listing all items, the manufacturer, and the name, address and phone number of the nearest authorized service representative.

C. Manuals shall include one copy of all submittal data required in Section 23 05 01 of these specifications, in addition to the operation, maintenance and lubrication instructions, parts lists, warranty (manufacturer and Contractor), manufacturer recommended spare parts list, test reports, and the following:

1. All warranties and guarantees and manufacturers' directions shipped with the equipment on the equipment and/or materials covered by the Contractor.
2. Reviewed and stamped drawings including fixture brochures, wiring diagrams, control diagrams, etc. on all equipment.
3. Reviewed shop drawings of all systems, including field prepared drawings for layout and installation of piping and ductwork.
4. Framed operating instructions (basic steps).
5. Any and all other data and/or drawings required during construction.
6. "As-built" plans, a complete set of the latest construction drawings marked up in red clearly showing the "as-built" conditions. Mark ups shall be submitted to the Architect/Engineer for review.
7. Four (4) sets of operating instructions for heating and cooling and other mechanical systems. Operating instructions shall also include recommended periodic maintenance instructions, including instructions for cleaning and lubricating procedures, seasonal changeover procedures, and step-by-step procedure for starting, stopping and operating each system in this particular building to promote energy conservation. These instructions must be written expressly for this project and shall refer to equipment, valves and devices by mark number from project schedules. Operating instructions and procedures shall be submitted in draft form, for approval, prior to final issue of complete brochures. Manufacturer’s advertising literature or catalogs shall not be acceptable for operating and maintenance instructions.
8. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.
9. Automatic Control System product data and shop drawings.
10. A complete description of the functions and operations of each piece of equipment including a description of how equipment operates in conjunction with automatic control systems.
11. Complete balance and test results of all systems certified by the registered Test and Balance Agency.
12. Valve lists for each of the various piping systems. Lists shall be tabulated on diagrammatic drawings of each piping system.
13. Valve tag charts and diagrams as specified elsewhere herein.
14. Any and all other data and/or drawings required during construction.
15. Records of manufacturer’s start-up of equipment.

D. All of the above data shall be submitted to the Architect/Engineer for approval at such time as the Contractor asks for his last inspection prior to the final Engineer site observation, but in no case, less than two (2) weeks before final Engineer site observation.

3.25 INSTRUCTION OF PERSONNEL

A. The Contractor shall prepare a complete Training Schedule and submit to the Architect/Engineer Agent for review and comment. Upon approval of the Training Schedule, the contractor shall execute the Training for the operating instructions, after the adjustment and functional testing period, to the Owner's operating personnel in order to familiarize them with the proper care and operation of the equipment. The thirty-six (36) hours shall be broken into a series of six (6) -six-(6) hour sessions. The written operating instructions referred to in paragraph above shall be used as a basis for this on-the-job instruction. The following shall be covered:

1. General familiarization and operating procedures for the entire mechanical installation.
2. Routine maintenance procedures for all mechanical equipment.
3. Specific operating and maintenance procedures for the refrigeration and heating system.
4. Specific operating and maintenance procedures for the automatic control systems.

B. Factory-trained technicians shall give Owner instructions on the operation of the refrigeration and heating equipment, pumps, air handling and fan coil units, control systems, water heating system, etc.

1. A competent technician employed by the Temperature Control Subcontractor shall be required to instruct the Owner in proper operating procedures and shall explain the significance of the temperature control literature filed in the maintenance manual over a period of five (5) days while the system is in continuous operation.

C. Contractor shall submit the name and qualifications of the temperature controls instructor(s) with a list of five (5) pervious projects and client contacts for reference. The Owner reserves the right to change instructor(s) upon verification of references.

D. Obtain receipt from the Architect/Engineer acknowledging completion of each item of instruction.

3.26 WARRANTY

A. All systems and components shall be provided with a one (1) year warranty from the time of final acceptance unless otherwise noted in the Contract Documents. The warranty shall cover all materials and workmanship. During this warranty period, all defects in materials and workmanship shall be corrected by repair or replacement without incurring any additional cost to the Contract.

B. Replacement of lost refrigerant and refrigerant compressor oil for one (1) year after the date of Architect's Final Certificate shall be made by the Contractor without additional charge for equipment supplied under Mechanical Division.

C. Refrigeration motor-compressor units shall have 4-year extended warranties effective for the period beginning one year from the date of building occupation. These warranties shall be supplied by the manufacturer, shall not be pro-rated, and shall provide for the no-cost replacement of failed motor-compressor units upon delivery to manufacturer's exchange-replacement distributor. Contractor shall deliver the 4-year extended warranties, properly filled in, with the maintenance manuals.

D, Excessive noise and/or vibration produced by any equipment supplied under Mechanical Division will be cause for rejection and shall be corrected by the Contractor at his expense.

E. Equipment that fails to deliver specified capacities or which causes the motor running currents to exceed the nameplate ratings at specified capacity will be rejected and shall be corrected by the Contractor at his expense.

F. The components of the mechanical systems furnished under this division of the specifications shall be guaranteed for a period one year from the acceptance thereof, either for beneficial use or final acceptance, whichever is earlier, against defective materials, design, and workmanship. Upon receipt of notice from the Architect of failure of any part of the equipment during the guarantee period, the affected part or parts shall be replaced promptly, which includes removing the defective part or parts, replacing and installing the new part or parts and at the expense of the Contractor.

3.27 FINAL SITE OBSERVATION

A. Final site observation shall not be made until each Subcontractor has completed his work in all details and has certified that he has thoroughly checked out his work, item by item, against the requirements of these Plans and Specifications as originally published and subsequently modified by reviewed changes. This check out shall be against the work called for in his Sub-Division of the Specifications.

B. If, during the final site observation, it is found that the Contractor has requested the inspection without compliance to the above requirements, the Contractor shall be responsible for paying any charges to the Architect/Engineer what they may deem warranted for extra time on his part caused by failure to observe the requirements.

END OF SECTION 230500

230501 - SCHEDULE OF SUBMITTAL DATA

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of the work is indicated on the Drawings and schedules and by the requirements of this section.

B. The construction requirements herein shall include appurtenant structures and buildings to which the systems are to be installed.

C. Shop drawings or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this contract. The Contractor shall submit the number of mechanical related shop drawings, product data, and samples to allow for required distribution as specified.

D. Before submitting Shop Drawings to the Owner's Representative for review, the Contractor shall examine them and satisfy himself that they are correctly representative of the material or equipment to which they pertain. The Contractor shall so note these Drawings before submitting them. The Contractor's review of the Shop Drawings is not intended to take the place, in any way, of the official review of the Owner's Representative and Shop Drawings which have not been reviewed by the Owner's Representative shall not be used in fabricating or installing any work. Work performed before this review is entirely at the risk and expense of the Contractor.

E. The review of Shop Drawings, product and maintenance data by the Owner's Representative shall not relieve the Contractor from responsibility for deviations from the Plans and Specifications unless he has, in writing, specifically called attention to such deviations at the time of submission and has obtained the permission of the Owner or Owner's Representative and has supportive documentation thereon; nor shall it relieve him from responsibility for error of any kind in the Shop Drawings. When the Contractor does call such deviations to the attention of the Owner's Representative, he shall state in his letter whether or not such deviations involve any extra cost. In addition, all deviations shall be clearly noted on the shop drawings in blue ink and completely highlighted. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.

F. Verification and assignment of dimensions, quantities, and construction means, methods, sequences or procedures, the correctness of which is set forth in the Contract Documents or submittal, shall be the sole responsibility of the Contractor.

G. Reproduction of design documents in any portion for use in a submittal is NOT ACCEPTABLE, and will be considered a violation of applicable copyright laws.

1.2 QUALITY ASSURANCE

A. All materials and equipment shall comply with requirements as specified in this section of these specifications.

B. All materials and equipment furnished and installed under this section of these specifications shall be new and in first class condition.

C. All materials and equipment furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor's expense.

D. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

E. Firms regularly engaged in manufacture of materials and equipment of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years are approved.

PART 2 – PRODUCTS

2.1 GENERAL

A. All products shall be new and bear all labels which are identified herein and by the applicable specification section and Contract Documents.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall not purchase, fabricate and/or install materials and/or equipment until Architect/Engineer has reviewed shop drawings / submittals for compliance with engineer design concept.

B. Any materials and/or equipment purchased, fabricated and/or installed prior to the Architect/Engineer's review found to be in non-compliance shall be removed or corrected as per instructions from Architect/Engineer at Contractor's expense.

3.2 SUBMITTAL DATA

A. General: The submittal data to be furnished for this project shall comply with Division 01.

B. HVAC, plumbing and fire protection submittal data shall be in separate volumes, with each volume containing one copy of all specified equipment shop drawings.

C. NOTE: It is the preference of the design team that, rather than bound submittals, submittals be in electronic form, submitted as .pdf files. Similar section tabbing to that required above for bound submittals shall be provided. Review comments for electronic submittals will be returned in the form of electronic files. Electronic submission, if properly identified and tabbed, will shorten review times. Provide one hard copy of submittals for Owner's record purposes.

D. The submittals are to be submitted as soon as practical for review (maximum of 30 days) after the Contract is awarded and before any materials or equipment is purchased, unless specified otherwise in the General and Supplementary Conditions and/or Specification sections or by the Owner or Owner's Representative. No submittals will be checked until ALL required submittals have been received by the Owner's Representative. Only building controls, ductwork and

sprinkler fabrication drawings may be submitted after the complete and bound submittal is reviewed and accepted by the Owner's Representative.

E. The Contractor shall submit with the submittal data a letter signed by the Contractor's Project Manager (or higher level officer of the firm) stating that all electrical characteristics of the mechanical equipment to be supplied have been fully coordinated with the electrical contractor. No submittal data will be checked until this letter is submitted. Any changes to the electrical requirements from the Contract Documents resulting from alternate equipment (other than design basis) being submitted shall be performed without any additions to the Contract Sum.

F. Product Data: Submit manufacturer's technical product data, including the following:

1. Model numbers.
2. Certified rated performance capacities and Energy Code efficiencies.
3. Furnished specialties and accessories.
4. Installation and start-up instructions.
5. Fan performance curves or tables and certification standards.
6. Motor information such as horsepower, electrical characteristics, IEEE rated motor efficiency, motor construction, motor size, motor temperature rating, motor manufacturer, wiring diagram, power factor, motor overload protection, motor noise rating and service factor.
7. Certified sound power level data for motor driven equipment such as: fans, split systems, booster pump, and energy recovery units.
8. Pipe hanger and support schedule with model number, size, location and features.
9. Mechanical insulation type, thickness, thermal conductivity, vapor barrier jacket, density, flame spread and smoke developed ratings.
10. Air pressure drop data through coils, filters, grilles, registers, diffusers, dampers, and unit casings, type of construction materials and finishes.
11. Air filter data including initial and final pressure drop, air quantities and efficiencies.
12. Grilles, registers and diffusers data including aspiration ability, temperature and velocity traverses, throw and drop data, and noise criteria ratings.
13. Energy Recovery units, heat pumps, fans, pumps, heaters, etc. including a schedule indicating each size and type furnished; unit designation; room location; quantity furnished; model number; accessories furnished; noise criteria rating for discharge and radiated sound levels (as applicable); unit pressure drop.
14. HVAC, plumbing piping and Fire Protection construction materials and methods, fitting details, and components.

G. Shop Drawings: Submit manufacturer's assembly type shop drawings indicating dimensions, weight loadings (shipping, installed and operating), required clearances, methods of assembly of components, and location and size of each field connection.

H. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to units. Submit manufacturer's ladder type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field installed.

I. Quality Assurance: Submit verification of compliance with applicable codes, test agencies, fire-rated classifications, test methods, etc. such as UL, FM, ASME, ASTM, NFPA, ETL, CSA, SWP and WOG working pressures, ASHRAE, AGA, NEMA, NEC, AWWA, MSS, EPA, ARI, ANSI, SMACNA.

J. Maintenance Data: Submit maintenance (including parts list of all components) and operating data in the operating and maintenance manual in accordance with requirements herein.

K. Submit attachment and fastening methods for piping and equipment to the Structural Engineer for approval.

L. Shop drawings shall be submitted for each of the following:

1. Cleanouts
2. Disconnect Switches
3. Ductwork, Accessories and Details (min. 1/4"=1'-0" scale fabrication drawings and floor plans and elevations)
4. Flexible Ductwork
5. Grilles, Registers and Diffusers
6. Louvers
7. Hangers and Supports
8. Hose Bibbs
9. Insulation (Piping and Ductwork)
10. Filters
11. Non-freeze wall hydrants
12. Pipe Hangers and Supports
13. HVAC, Plumbing, and Fire Protection Piping and Piping Specialties Materials and Methods
14. Plumbing Drains
15. Plumbing Fixtures, Carriers and Fittings
16. Strainers
17. Test, Adjusting and Balancing Reports and Forms (Blank and Final)
18. Domestic & Sanitary Piping
19. Valves
20. Ductwork Accessories (Fire/Smoke Dampers, Fire Dampers, Access Doors, Turning Vanes, Flexible Connections, Control Dampers and Operators)
21. Grease Trap
22. Water Heaters and Storage Tanks
23. Coordination Drawings 1/4" scale composite coordination drawings indicating the ductwork with top and bottom of duct and mechanical piping elevations, air distribution, light fixtures, sprinkler piping with top and bottom of piping, sprinkler head locations and any other ceiling mounted devices such as fire alarm items, HVAC air distribution devices and exit signs.
24. Fire Protection System (components and devices, fire pump and accessories, air pumps/compressors for dry system, valves, flow and tamper switches, piping hydraulic calculations, fabrication drawings of sprinkler piping with bottom elevations of piping, sprinkler head locations and any other ceiling mounted devices such as light fixtures, HVAC air distribution devices, fire alarm items, and exit signs)
25. Through-Wall Air-Conditioning Units
26. Split System Air-Conditioners
27. Variable Refrigerant Systems
28. Dedicated Outdoor Air Systems
29. Make-Up Air Units
30. Fans
31. Electric Heaters
32. Vibration Isolation
33. Domestic Water Booster Pumping Systems

M. Submit or provide to the Owner's Representative the following prior to occupancy of the project by the Owner and authorization for final billing:

1. As-built drawings for ductwork and mechanical piping, equipment, plumbing and Fire Protection systems.
2. All guarantees and warranties.

3. Certify disinfection of domestic water service. Submit three (3) copies of local Health Department approval.
4. Submit written certification of the completion of the lubrication indicating each piece of equipment for which the lubrication was performed. A list of the manufacturer's lubrication schedule shall also be included.

N. The Contractor MAY submit three (3) copies of a letter (one electronic copy), signed by an officer of the company, stating that the items listed below meet or exceed criterion of the plans and specifications in lieu of submitting shop drawings. The letter is to include a list of each item to be used on the project along with the manufacturer and model number. Only specified acceptable manufacturers will be allowed.

1. Cleanouts
2. Dampers
3. Drains
4. Flexible Connectors
5. Flexible Duct
6. Pipe Hangers and Support
7. Vacuum Breakers
8. Water Supplies and Stops

3.3 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Prepare maintenance manuals for project closeout in accordance the following requirements. Complete operating and maintenance instructions shall be provided. Three (3) separate copies (two for the Owner, one for the Owner's Representative plus one digital copy on a USB drive) shall be provided, and each copy shall be bound in a separate 3-ring, loose leaf notebook. Include the following information for equipment items:

1. Operating instructions shall be provided for each system, and shall include a brief system description, a simple schematic and a sequence of operation. Operating and maintenance instructions shall be included for each piece of equipment.
2. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
3. Manufacturer's printed operating procedure shall include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions and procedures which refer to the equipment and valves by designation mark number from project schedules. Manufacturers' Standard literature is acceptable for each piece of equipment. However, the contractor shall prepare a SYSTEM Operating and Maintenance manual including overall system descriptions, operating and energy conservation techniques.
4. A system wiring and control diagram shall be included in the operating and maintenance instructions.
5. Documentation of all tests performed for piping and ductwork.
6. Prior to final Engineering site observation, provide the services of a competent representative to instruct the Owner in the operation of all systems. This instruction shall include a complete walk-through of all equipment and systems. The Owner's Representative reserves the right to attend any such meeting and shall be duly notified a minimum of one (1) week in advance.

END OF SECTION 230501

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR EQUIPMENT

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of the work is indicated on the Drawings and schedules and by the requirements of this section.

B. The construction requirements herein shall include appurtenant structures and buildings to which the system is to be installed.

C. Contractor shall furnish and install all motors, starters and disconnect switches required. Where motors, starters and/or disconnect switches are furnished by equipment manufacturers, they shall comply with all requirements of this section of these specifications.

D. All mechanical equipment rated greater than 1,000 watts, with an inductive reactance load component, shall have a power factor of not less than 85% under rated load conditions. Power factor of less than 85% shall be corrected to at least 90% under rated load conditions.

E. All items required for a complete installation shall be provided.

1.2 QUALITY ASSURANCE

A. All motors, starters, and disconnect switches shall comply with requirements as specified in this section of these specifications.

B. All motors, starters, and disconnect switches furnished and installed under this section of these specifications shall be new and in first class condition.

C. All motors, starters, and disconnect switches furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor’s expense.

D. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

E. Firms regularly engaged in manufacture of motors, starters, and disconnect switches of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years are approved.

F. All motors furnished by equipment manufacturers larger than 2 HP shall comply with this section of these specifications.

G. All motors to be furnished and installed under this section of these specifications shall be the product of one manufacturer, unless motors have been furnished by equipment manufacturer.

H. All starters and disconnect switches to be furnished and installed under this section of these specifications shall be the product of one manufacturer.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's fire pump equipment specifications, installation and start-up instructions, and capacity and ratings, with selection points clearly indicated.

B. Shop Drawings: Submit assembly type shop drawings indicating dimensions, weights, required clearances, and methods of assembly of all components.

C. Wiring Diagrams: Submit ladder type wiring diagrams for all components, clearly indicating all required field electrical connections.

D. Maintenance Data: Submit maintenance data and parts lists for each item of fire protection equipment. Include "trouble-shooting" maintenance guides. Include this data in maintenance manual.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in new and in first class condition.

B. Store motors, starters, and disconnect switches utilizing suitable means so as to protect from weather, construction work traffic and contamination. Motors, starters, and disconnect switches shall not be stored outdoors. Contractor shall cover in a suitable manner to prevent contamination from water, dirt, mud and/or debris.

C. Motors, starters, and disconnect switches found to be contaminated with water, dirt, mud and/or other debris shall be condemned as being unsuitable for use on this project and shall be removed from the job site at the Contractor’s expense.

1.5 COORDINATION

A. Coordinate with Electrical Contractor and Control Contractor insofar as voltage, phase, amperage, control voltage, etc. prior to purchasing motors, starters and/or disconnect switches.

1.6 REFERENCES

A. NEMA Standards MG 1: Motors and Generators

B. NEMA Standards ICS 2: Industrial Control Devices, Controllers, and Assemblies.

C. NEMA Standard 250: Enclosures for Electrical Equipment

D. NEMA Standard KS 1: Enclosed Switches

E. Comply with National Electrical Code (2014) and NFPA 70.

1.7 ELECTRICAL WORK

A. General: All electrical equipment provided under this Division shall comply with the electrical system characteristics indicated on the Drawings and specified in Division 26.

B. All power wiring and final power connections to the system shall be provided under Division 26.

C. Control wiring be provided under Division 23 and extended from power circuits, with 120 volt to 24 volt transformers, as needed to meet the requirements of the design. All wiring for voltages higher than 30 volts shall be done by a licensed electrician.

D. All electrical characteristics shall be taken from the Drawings and Specifications and coordinated before equipment is ordered or submitted.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Motors as manufactured by ABB Control Inc., Baldor, General Electric, Gould, Marathon, Reliance, Siemens, Toshiba, U.S. Motors, or Westinghouse are acceptable.

B. Motor Starters, Disconnect Switches, and Combination Starter/ Disconnect Switches as manufactured by ABB Control Inc., Allen-Bradley, Cutler-Hammer, Furnas, General Electric, Reliance, Square D, and Westinghouse are acceptable.

2.2 MOTORS

A. The following are basic requirements for simple or common motors. Unless specifically noted otherwise in other sections of this Specification, all motors and motor controllers shall meet the requirements specified in this Section. All motors shall be built in accordance with the current applicable IEEE, and NEMA standards, and shall have voltage, phase, frequency and service as scheduled. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.

1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
2. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.
3. Temperature Rating: Rated for 40˚ C environment with maximum 50˚ C temperature rise for continuous duty at full load (Class A Insulation).
4. Starting Capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly time spaced starts per hour for manually controlled motors.
5. Each motor shall be suitable for the brake horsepower of the driven unit, rated with 1.15 for poly-phase and 1.35 for single phase minimum service factors. The motor shall be capable of operating continuously at such temperature rises, and shall be capable of withstanding momentary overloads of 25 percent without injurious overheating.
6. Motor Construction: NEMA Standard MG 1, general purpose, Part 30 (for all constant speed) and Part 31 (for all variable speed motors) continuous duty, Design "B", except "C" where required for high starting torque. Motors shall be high efficiency type unless specified to be “premium high efficiency” type in the specific equipment sections elsewhere in these documents.
7. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
8. Bearings:
    a. Ball or roller bearings with inner and outer shaft seals;
    b. Regreasable, except permanently sealed where motor is normally inaccessible for regular maintenance;
    c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor;

d. For fractional horsepower, light duty motors, sleeve type bearings are permitted.

9. Enclosure Type:
   a. Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation; guarded drip-proof motors where exposed to contact by employees or building occupants;
   b. Weather protected Type I for outdoor use, Type II where not housed;
10. Overload Protection: Built-in thermal overload protection for motors less than 1/2 horsepower and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
11. Noise Rating: "Quiet" rating on motors located in occupied spaces of building.
12. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

B. Each item of motor driven equipment shall be furnished complete with the motors and drives as required to perform the specific function for which it is intended, scheduled, and specified.

C. Motors larger than 1/2 horsepower shall have bearings with pressure grease lubrications fittings.

D. Motors connected to drive equipment by belt shall be furnished with adjustable slide rail bases except for fractional horsepower motors which shall have slotted bases. Motor leads shall be permanently identified and supplied with connectors.

E. Unless otherwise indicated, motors smaller than 1/2 horsepower shall be ECM, capacitor start or split phase type designed for 120 volt, single phase, 60 cycle alternating current. Shaded pole motors are not acceptable except 35 watts and smaller. Motors 1/2 horsepower and larger shall be squirrel cage induction type, 3 phase, 60 cycle alternating current.

F. Multispeed motors shall, except as noted, be consequent pole, variable torque, single winding. When the speed ratios or the load characteristic dictates, the multi-speed motors shall be separate winding types. Variable speed motors operating over an adjustable range of speeds shall be motors specifically designed and rated for this duty powered by variable frequency drives.

G. If the Contractor proposes to furnish motors varying in horsepower and/or characteristics from those specified, he shall first inform the Owner's Representative of the change and shall then coordinate the change with all affected trades and shall pay all additional charges in connection with the change.

H. Each starter, contactor, push button station, and thermal overload switch shall be appropriately identified by engraved laminated Bakelite nameplates with 1/4" high white cut letters.

2.3 STARTERS, ELECTRICAL DEVICES, AND WIRING

A. Motor Starter Characteristics:
   1. Enclosures: NEMA 1, general purpose enclosures with two (2) padlock ears, except in wet locations shall be NEMA 3R with conduit hubs, or units in hazardous locations which shall have NEC proper class and division.
   2. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.

B. Manual Switches Shall Have:
   1. Pilot lights with push-to-test feature for all motors and extra positions for multi-speed motors.
   2. Controllers with double break silver alloy contacts, visible from both sides of the controller.

3. Overload protection consisting of melting alloy type thermal overload relays.
4. On-off Positions
5. Switch capable of being padlocked-off.

C. Magnetic Starters:
1. Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
2. Trip-free thermal overload relays, each phase.
3. Interlocks and similar devices as required for coordination with control requirements of Division-23 Building Temperature Controls section.
4. Built-in 120 volt control circuit transformer, fused from line side, where service exceeds 240 volts.
5. Externally operated manual reset.
6. Provide one set of spare auxiliary contacts (1 normally open set and 1 normally closed set) in each motor starter for future use by a building automation system in addition to seal-in contact.

D. Motor Connections:
1. Flexible conduit, except where plug-in electrical cords are specifically indicated.

E. Starters for 3 phase motors shall be magnetic type and unless otherwise indicated shall be as follows:
1. NEMA 1 enclosure, combination line starter with disconnect (not fused) and thermal overload protection on all 3 phases. Starters outdoors shall have NEMA 3R enclosure.
2. 24 V coil or 120 V coil (to agree with control circuit - not to exceed 120 V) and control transformer built-in, with fuses in primary leads and in hot secondary lead, other secondary grounded.
3. H.O.A. control for all automatically controlled starters and remotely controlled starters. Furnish ON-OFF selector switch where there is no automatic, remote or interlock control.

F. Starters for single phase motors shall be manual type motor rated switches with thermal overload device (except omit overload device from switches for motors with built-in overload protection) and NEMA type 1 enclosure, except for in toilets or public spaces, or when noted for flush mounting. In such locations, provide jumbo stainless steel flush plate and pull box. Provide pilot lights in starters when noted.

2.4 CAPACITORS

A. Capacitor features:
1. Individual unit cells
2. All welded steel housing
3. Each capacitor internally fused
4. Non-flammable synthetic liquid impregnate
5. Craft tissue insulation
6. Aluminum foil electrodes
7. KVAR size shall be as required to correct motor power factor to 90 percent or better and shall be installed on all motors 1 horsepower and larger, that have an uncorrected power factor of less than 85 percent at rated load.

2.5 DISCONNECT SWITCHES AND COMBINATION STARTER/DISCONNECTS

A. Fusible Switches: Fused, each phase; general duty; horsepower rated; non-teasible, quick-make, quick-break mechanism; dead front line side shield; solderless lugs suitable for

copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "OPEN" position; arc quenchers; capacity and characteristics as indicated.

B. Non-fusible Switches: For equipment 2 horsepower and smaller, shall be horsepower rated unless otherwise noted; toggle switch type; quantity of poles and voltage rating as indicated. For equipment larger than 2 horsepower, switches shall be the same as fusible type.

C. When available, disconnect switches shall be factory installed as part of the equipment.

D. When equipment manufacturer recommends over current protection by HACR circuit breaker or fuses, the disconnect switch for that piece of equipment shall be fused at the maximum recommended fuse size. In other circumstances, the disconnect switch shall be non-fused.

E. Contractor shall coordinate disconnect switch size and configuration with the equipment manufacturer’s recommended maximum fuse size or other applicable data.

F. Combination Starter/Disconnects:
1. Full-Voltage Non-Reversing: Provide full-voltage non-reversing starters combination motor circuit protector type consisting of contactor, overload relay, motor circuit protector/disconnect control power transformer, control circuit fuses and cover mounted control pushbuttons, hand-off-auto selector switches and green "run" pilot light. Equip starters with manual reset operator on cover and disconnect with provisions for two (2) padlocks on unit operating handle. Include indication of switch position and handle defeater mechanism to access unit with switch in the "on" position. Enclosure shall be NEMA Type 1 with a three (3) phase protection unless otherwise noted on contract drawings.
2. Each starter, contactor, push button station, and thermal overload switch shall be appropriately identified by engraved laminated Bakelite nameplates with 1/4" high white cut letters.
3. Provide one set of spare auxiliary contacts (1 normally open set and 1 normally closed set) in each motor starter for use by a building automation system in addition to seal-in contact including factory installed transformer for 120 volt or 24 volt as required for a fully operational and coordinated control system.

PART 3 – EXECUTION

3.1 INSTALLATION

A. All electrical equipment shall be installed per Division 26 and NEC requirements and the equipment manufacturer's written instructions. Motors shall be properly aligned before starting equipment. Turn over all starters, disconnects and combination starter/disconnects that require field installation to the electrical contractor.

B. Every item of motor-driven equipment shall be furnished complete with motors, drives and associated control equipment, including remote pilot devices as required to perform the specific function for which it is intended

C. Install equipment complete with all components, connecting services and adjustments necessary for it to operate safely and in compliance with requirements of the Contract Documents.

3.2 ELECTRIC WIRING

A. The Electrical Division includes mounting of job installed starters, power wiring through job mounted starters to motors and/or to power terminals of prewired equipment, with wiring and raceway as indicated on the Electrical Drawings. All additional wiring and raceway necessary for the mechanical systems shall be provided as part of the work under the Mechanical Division.

B. Control and interlock wiring for job installed controls is specified under “Automatic Temperature Control” section.

C. Flexible cable shall be installed with slack so that it does not transmit vibration in connections to all motors and to controls mounted on mechanical equipment. All wiring shall conform to the Electrical Division of the specifications.

D. Equipment specified as factory wired or pre-wired shall be checked by the Contractor and if the wiring is incomplete or defective, it shall be completed and/or corrected as part of the work under the section in which the equipment is specified.

END OF SECTION 230513

SECTION 230529 - HANGERS AND SUPPORTS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of the work is indicated on the Drawings and schedules and by the requirements of this section.

B. The construction requirements herein shall include appurtenant structures and buildings to which the system is to be installed.

C. Furnish hangers to support the required loads. Where necessary, supports shall be designed to permit movement due to expansion and contraction. Where Drawings show details of supports and anchors, conform to details shown. Where details are not shown, conform to general requirements specified herein

D. The construction requirements outlined in these specifications shall include appurtenant structures and buildings to which the systems are to be installed.

E. All exterior components shall have seacoast and weather-resistant coating.

F. Regarding mechanical equipment attachments: Mechanical equipment (including supporting racks, curbs and equipment tie-downs), and, the attachment of the these elements to one another or to the supporting building structure, shall be designed to resist the wind pressures required by the Florida Building Code, Building; and the Florida Building Code, Mechanical, Section 301.15. design shall be by a Florida licensed professional engineer. the design and inspection of these components shall be by others as they are not part of the primary structural system of the building.

G. Regarding fastening to post-tensioned concrete slabs: The existing structure consists of post-tensioned slab construction. where fasteners to existing concrete slabs are required, installation shall only proceed when one the following requirements are satisfied as necessary to avoid potential damage to the building structure:

1. The penetration depth of the specified fastener is 3/4" or less.
2. The penetration depth of the specified fastener is 3/4" or more, and it has been demonstrated by means of x-ray analysis or another rational scientifically proven method that no conflict occurs between existing tendon locations and the intended placement location of the fastener.

1.2 QUALITY ASSURANCE

A. All hangers, foundations, supports, and anchors shall comply with requirements as specified in this section of these specifications.

B. All hangers, foundations, supports, and anchors furnished and installed under this section of these specifications shall be new and in first class condition.

C. All hangers, foundations, supports, and anchors furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor’s expense.

D. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

E. Firms regularly engaged in manufacture of hangers, supports, and anchors of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years are approved.

F. All hangers, supports, anchors, and guides shall be in accordance with the American National Standard Code for Pressure Piping, ANSI/B31.1 with Addenda 31.1 OA-69 and Federal Specification WW-H-171E.

G. Regulatory Requirements: Comply with applicable plumbing and mechanical codes pertaining to product materials and installation of supports and anchors.

H. Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Hangers, supports, and components shall be listed and labeled by a NRTL where used for fire protection piping systems. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

I. All hangers, support, anchors, and guides shall be in accordance with the American National Standard Code for Pressure Piping, ANSI B31.1 with addenda 31.1 OA-69.

J. Hangers and supports for fire protection and sprinkler system shall conform to the requirements of NFPA 13, latest edition, and be UL listed.

1.3 SUBMITTALS

A. Prior to submittal of product data for review to Architect submit methods of attachment to structure to the Architect for approval by the Structural Engineer. Include copy of approved methods of attachment to structure with the product data submittal.

B. Submit catalog sheets, dimensional data, weights and capacities of all inserts, beam clamps, anchors, hangers, etc.

C. Submit Shop Drawings

1. Indicate locations of all inserts, beam clamps, anchors, or other means of structural attachment.
2. Submit hanger assembly details, indicating size and type of hangers, insulation shields and/or saddles, rod and/or bolt sizes, vibration isolation (if required), structural attachments, supplementary support steel (if required), and other pertinent data.
3. Coordinate hangers requiring vibration isolators with requirements of Section 23 05 48 of these specifications.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in new and in first class condition.

B. Store hangers, supports, and anchors utilizing suitable means so as to protect from weather, construction work traffic and contamination. Where hangers, supports, and anchors are stored outdoors, Contractor shall cover in a suitable manner to prevent contamination from water, dirt, mud and/or debris. Hangers, supports, and anchors shall not be laid on grade for storage.

C. Hangers, supports, and anchors found to be contaminated with water, dirt, mud and/or other debris shall be cleaned and restored to new condition to the satisfaction of the Architect. All hangers, supports, anchors and foundation materials found damaged, or determined to be unsuitable for use by the Architect, shall be deemed unfit for use on this project; these shall not be used and shall be removed from the job site at the Contractor's expense.

1.5 DEFINITIONS

A. Terminology used in this section is defined in MSS SP-90.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Inserts shall be as manufactured by B-Line, Grinnell, Michigan, PHD, or unistrut.

B. Concrete anchors shall be as manufactured by Hilti, Phillips or Rawl.

C. Beam clamps shall be as manufactured by B-Line, Grinnell, Michigan, or PHD.

D. Hangers shall be as manufactured by B-Line, Grinnell, Michigan, or PHD.

2.2 MANUFACTURED UNITS

A. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58. All hangers and supports shall have a factory-applied prime coating.

B. Components shall have galvanized coatings where installed for piping and equipment that will not have field-applied finish.

C. Pipe attachments shall have copper or nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing. Field painting in lieu of the above will not be acceptable.

2.3 UPPER ATTACHMENTS

A. Support piping in steel construction with adjustable beam clamps and tie rods, Grinnell fig. 218, or side beam brackets bolted or welded to the side of the beam. Beam clamps shall be tack welded or strapped to beams.

B. Where hangers are required between structural members (beams or joist) provide side beam brackets, Grinnell Fig. 202, and all auxiliary steel for the installation of the pipe hangers. Supports shall be designed in accordance with the AISC Steel Handbook and shall receive a field coat of zinc chromate primer.

2.4 WALL PIPING SUPPORTS

A. Where piping is run adjacent to walls or columns, welded steel brackets Grinnell Fig. 195 and 199 may be used. The bracket shall be bolted to the wall and a back plate of such size and thickness as to properly distribute the weight.

B. Piping secured to walls shall be mounted on unistrut bolted to wall studs with carbon steel straps,

Grinnell Fig. 263. Install supports on 6'-0" centers.

C. All exterior components shall have seacoast and weather-resistant coating.

2.5 FLOOR PIPING SUPPORTS

A. Where pipe lines runs are located next to the floor or outside the building above grade and no provision for expansion are required, support piping with roller type pipe supports with prefabricated support stands. Where pipe lines are slab mounted, provide unistrut 6'-0" on center (min.) bolted to the slab. Secure piping with U-bolt, Grinnell Figure 137, standard unistrut pipe clamps, or galvanized steel straps.

B. All exterior components shall have seacoast and weather-resistant coating.

2.6 ROOF SUPPORTS

A. Support all piping on building roof with U-bolt, Grinnell Figure 137, standard unistrut pipe clamps, or galvanized steel straps, fastened to coated unistrut. Unistrut supports shall be mounted to manufactured equipment supports, flashed and attached to roof.

B. Curb rails, for mounting equipment, piping and ductwork supports, etc. on the roof shall be Pate model ES-1, or approved equivalent. Curb rails shall have 18 ga. galvanized steel shell, base plate and cap/counter flashing; all welded construction; internal bulkhead reinforcement; pressure treated wood nailer; 3” cant; and a minimum 8” height. Secure supports to curb rails. Seal all curbs water tight with silicon based sealant.

C. Piping and ductwork supports shall be spaced a maximum of 6 feet on center, and at all changes in direction.

D. All exterior components shall have seacoast and weather-resistant coating.

2.7 INTERMEDIATE ATTACHMENTS

A. Supports for horizontal piping shall be all threaded carbon steel, ASTM A-107, Grinnell Fig. 146, of the following sizes:

Pipe Size	Hanger Rod Diameter
3" and smaller	1/2"
4" and 5"	5/8"
6"	3/4"
8"	7/8"

2.8 PIPE HANGERS & ATTACHMENTS

A. Hangers for cast-iron, condensate, and insulated plumbing and refrigerant piping horizontal piping where provision for expansion are not required shall be Grinnell Fig. 260., clevis type with vertical adjustment.

B. Fire protection piping shall be supported with tear drop, Grinnell figure 69 for up through 2” diameter piping; clevis hanger, Grinnell figure 260 for 2-1/2” diameter and larger.

C. Piping may also be supported with trapeze type unistrut hangers per section 3.02 below, in lieu of clevis or tear drop hangers to provide maximum clearance above floor.

2.9 EQUIPMENT FOUNDATIONS AND SUPPORTS

A. Steel Plates, Shapes and Bars: ASTM A36.

B. All foundations or supports for equipment shall conform to the following requirements unless otherwise specified or noted on the plans. All foundations and supports shall be coordinate and approved by Structural Engineer prior to fabrication and installation.

C. Pads, curbs, supports and foundations shall be supported from or rest on structural floor slabs.

D. Pads shall be a minimum of 6" greater, on all sides, of equipment footprint.

E. Foundations and supports shall be as follows:

1. Dedicated Outdoor Air Units – on 12" high curb rooftop or 4” high concrete pad indoors.
2. In-Line and Cabinet Fans – Suspended from structure above with hanger rod at each support point with vibration isolators.
3. Unit Heaters - Suspended from structure above with hanger rod at each support point.
4. Horizontal Fan Coil Units – Suspended from structure above with hanger rods and vibration isolators. See drawings for additional details.
5. Condensing Units – Roof mounted on curb rails for level equipment installation.
6. Condensing Units – Grade mounted; Provide equipment pad for all equipment mounted on grade. Pads for 7.5-20 split system condensing units (CU's) and condensers (ACCU's) shall be 6" thick concrete, full size of equipment footprint, with 8" x 8" continuous footing around full perimeter. Provide 6 x 6 - W1.4 x W1.4 steel rebar and wire mesh reinforcement. Pads for 1-5 ton split system condensing units shall be the same, or may be substituted with 4" thick light weight concrete prefabricated pads with wire mesh reinforcement and plastic coated exterior. Mount level where indicated on plans. Crown top of pads with 1/8" per slope from center to edges for water runoff.
7. Energy Recovery Units – Mounted on roof curb for level equipment installation.
8. Kitchen Make-Up Air Unit – Mounted on roof curb for level equipment installation.
9. Exterior Ductwork and Piping – Roof mounted on curb rails for level installation. See drawings and details for additional information.
10. The penetration depth of the specified fastener is 3/4" or less.
11. The penetration depth of the specified fastener is 3/4" or more, and it has been demonstrated by means of x-ray analysis or another rational scientifically proven method that no conflict occurs between existing tendon locations and the intended placement location of the fastener.

2.10 MISCELLANEOUS MATERIALS

A. Steel Plates, Shapes and Bars: ASTM A36.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which supports and hangers are to be installed. Do not proceed with installing until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clips, clamps and attachments to support piping properly from building structure; comply with MSS SP-69 and SP-89. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible. Install supports with maximum spacing complying with MSS SP-69. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe as specified above for individual pipe hangers. Do not pierce waterproofing with support bolts. All ferrous metal hangers and supports, not otherwise coated shall be provided with a field applied coat of zinc chromate primer prior to installation. In lieu of field painting the contractor may furnish cadmium plated, or galvanized hangers and supports.

B. Install building attachments within concrete or to structural steel or wood framing: Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.

C. Install hangers and supports complete with necessary hanger clips, inserts, bolts, rods, nuts, washers, and other accessories. Support horizontal equipment independently of the piping system. Hang pipe from substantial building structure. Pipe shall not be hung from other piping. Provide a hanger within one foot of each tee fitting, pipe elbow and change in direction. Provide a hanger within one foot of each riser in addition to the riser clamp support at floors. Unless specified otherwise, provide the following support spacing. Spacing for PVC and CPVC piping shall be more frequent than below, as required by the pipe manufacturers.

PIPE SIZE (inches)	STEEL	COPPER OR BRASS
1/2	6	5
3/4	6	5
1	6	5
1-1/4	10	8
1-1/2	10	8
2	10	8
2-1/2	12	10
3	12	10
3-1/2	12	10
4, 6	12	12
8	16	16

D. Maximum spacing of hangers on cast iron soil pipe shall be five feet and hangers shall be provided at all changes in direction and branch pipe connections. Provide hangers on each cast iron pipe section between no-hub clamps. Hanger rods to support piping from the structural or supplementary steel construction shall not exceed four feet in total length. Where pipe support assemblies exceed four feet in total length, the Contractor shall furnish and install factory fabricated channels and associated accessories secured to the building structure.

E. Where codes having jurisdiction require closer spacing, the hanger spacing shall be as required by code in lieu of the distances specified herein.

F. Field-Fabricated, Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required unistrut; weld steel in accordance with AWS D-1.1. Provide all-thread rods with nuts and washer secured to the structure from trapezes.

G. Support plumbing, fire protection and mechanical systems piping independently from other piping and conduit systems.

H. Install hangers and supports to allow controlled movement of piping systems.

I. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

J. Pipe Supports: Install hangers and supports and so that maximum pipe deflections allowed by ASME B31.9 Building Services Piping Code is not exceeded. Hangers for CPVC shall be spaced per pipe manufacturer's installation recommendations.

K. Insulated Piping: Comply with the following installation requirements:

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
2. Shields: Install protective sheetmetal shields MSS Type 40 on domestic water, condensate drain, and horizontal storm piping. Shields shall span an arc of 180 degrees and shall be 12 or 18 inches long as noted below. Inserts shall be provided at all pipe hangers except plumbing piping of 1-1/2" diameter and less and all condensate piping. Inserts shall be calcium silicate or foamglass 2" longer than the shield length below, 360˚ around pipe.

NPS	LENGTH	THICKNESS
1/4 THROUGH 3-1/2	12	0.048
4	12	0.060
5 & above	18	0.060

L. All penetrations of roof, flashing, and roof mounted supports shall be coordinated with roofing contractor and shall be installed in compliance with roofing manufacturer's instructions and Architectural documents. Install per approved methods and with water-tight sealing to provide leak-free penetrations and supports.

M. Install restraints and fasteners as required to meet local seismic and wind load criteria. Provide equipment and construction that meets these requirements; install additional supports, vibration isolation, specialty connections/fittings, and attach roof curbs to structure as necessary. Provide rational analysis calculations if required. Coordinate with Architect and Structural Engineer. See specification section 23 05 48 for additional information.

3.3 EQUIPMENT SUPPORTS

A. For equipment hung from structure above, fabricate structural steel, or use angle iron or unistrut and suspend with hanger rods. Provide vibration isolators at hanger rods for all equipment with motors.

B. Concrete foundations are required by equipment furnished under Division 21, 22, and 23. All concrete work performed shall conform entirely to the requirements of the General Specifications which describe this class of work. They shall be constructed in conformance with the recommendations of the manufacturer of the respective equipment actually applied, and with the approval of the Architect. Concrete foundations shall be minimum 3000 PSI reinforced concrete; surfaces shall be troweled smooth; all edges and corners shall be neatly chamfered.

C. All structural supports shall be fabricated and installed as detailed on structural drawings. Submit shop drawing of structural supports for approval, prior to fabrication and erection, per specification Section 23 05 01.

3.4 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for 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. Remove rust from all ferrous hanger equipment (hangers, rods and bolts) and apply one coat of, zinc chromate, or rush inhibitive primer immediately after erection.

D. Piping at all equipment shall be supported to prevent strains or distortions in the connected equipment and control valves. Piping at equipment shall be supported to allow for removal of equipment, valves and accessories with a minimum of dismantling and without requiring additional support after these items are removed.

E. All hangers shall be secured to approved structural inserts or expansion shields wherever possible and practicable. Drilling where required shall be done by the Contractor under this Section of the Specifications. The use of explosives for driving shields and inserts is prohibited.

F. Friction clamps shall be installed at the base of all plumbing risers. Friction clamps shall not be supported from or rest on floor sleeves.

3.5 ADJUSTING

A. Hanger Adjustment: Adjust hangers for suspended equipment to distribute loads equally on attachments and spring isolators to achieve level installation.

B. Hanger and Support Adjustment: Adjust hangers and supports to distribute loads equally on attachments and spring isolators as applicable, and to achieve level installation of piping (except drainage and vent piping which shall slope as specified).

C. Touch-Up Painting: Immediately after erection of anchors and supports, clean field welds and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA-1 requirements for touch-up of field-painted surfaces.

D. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION 230529

SECTION 230553 - IDENTIFICATION FOR PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Contractor shall furnish and install all pipe markers, valve tags, name plates and valve charts as required and specified herein.

1.2 QUALITY ASSURANCE

A. All pipe markers, valve tags, name plates and valve charts shall comply with requirements as specified in this section of these specifications.

B. All pipe markers, valve tags, name plates and valve charts furnished and installed under this section of these specifications shall be new and in first class condition.

C. All pipe markers, valve tags, name plates and valve charts furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor's expense.

D. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

E. Firms regularly engaged in manufacture of pipe markers, valve tags, and name plates of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years are approved.

1.3 SUBMITTALS

A. Submit catalog data sheets.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in original, new and unopened packages and/or containers bearing manufacturer's name, and label identifying contents.

B. Pipe markers and valve tags shall be handled in accordance with manufacturer's instructions.

PART 2 – PRODUCTS

2.1 GENERAL

A. All above ground piping inside the building shall be identified with color bands as hereinafter specified.

B. All valves inside and outside the building shall be identified with brass tags as hereinafter specified.

C. All equipment inside and outside the building shall be identified with name plates as hereinafter specified.

2.2 SUBSTITUTIONS

A. No form of identification other than that specified hereafter shall be acceptable unless specifically approved by the Architect/Engineer.

2.3 PIPING IDENTIFICATION

A. Piping identification shall be with plastic snap-around markers.

B. All markers shall meet ANSI A13.1 standards and shall be as follows:

TABLE I - BAND WIDTH AND LETTER SIZE

OUTSIDE DIAMETER OF PIPE COVERING	MIN. WIDTH OF COLOR BAND	MIN. SIZE OF LEGEND LETTERS AND NUMERALS
3/4" to 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1/1/4"
8" to 10"	24"	2-1/2"
Over 10"	32"	3-1/2"

Note: All dimensions are given in inches.

TABLE II - IDENTIFICATION

PIPING TYPE	LETTER COLOR	BAND COLOR
Domestic Cold Water	Black	Green
Domestic Hot Water	Black	Yellow
Domestic Hot Water Circulating	Black	Yellow
Natural Gas	Black	Yellow
Sanitary Drain	Black	Green
Fire Sprinkler	White	Red
Fire Protection Water	White	Red
Refrigerant	Black	Yellow
Condensate Drain	Black	Yellow
Chilled Water	White	Green

C. All bands shall have arrows indicating direction of flow.

D. All bands shall be one piece and shall contain lettering and arrows.

E. Identification shall have 360 degrees visibility.

F. Printing on bands shall have a laminated clear covering and shall be impervious to steam and weather.

2.4 VALVE IDENTIFICATION

A. Tags shall be 1-1/4" minimum size and shall be 18 gauge brass. Identification numbers shall be stamped in tags and filled with black enamel.

B. Valve tags shall be round, lettered and numbered as follows:

1. Cold water - CW-1, CW-2, CW-3 ..... for domestic cold water.
2. Hot water - HW-1, HW-2, HW-3 ..... for domestic hot water.
3. Hot water circulating - HWC-1, HWC-2, HWC-3 ..... for domestic hot water circulation.
4. Fire sprinkler - SPK-1, SPK-2, SPK-3..... for sprinkler pipe.
5. Chilled water – CHW-1, CHW-2, CHW-3 ….. for chilled water.

2.5 EQUIPMENT NAME PLATES

A. General: Install 1/8" thick engraved black plastic laminate sign engraved with white letters, complying with Federal Specification L-P-387 on or near each item of mechanical equipment, each access panel concealing valves and each operational device, as specified herein and for each item or device. Fasteners shall be self-tapping stainless steel screws, except contact type permanent adhesive where screws should not penetrate the substrate. In addition to mechanical equipment, provide signs for the following general categories of equipment and operational devices:

1. Operating valves, starters, disconnects, combination starter/disconnects, including safety devices.

B. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.

C. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment. Relocate any mechanical identification device which has become visually blocked by the work of this or any other Division.

3.2 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers on each system indicated to receive identification only after the piping has been tested, insulated and painted as specified, and include arrows to show normal direction of flow. Provide underground type plastic line markers of the manufacturer's standard permanent, bright colored, continuous printed plastic tape, intended for direct burial service, not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates the type of service of the buried piping. Provide underground piping identification during back-filling/top-soiling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over the buried line at 6" to 8" below finished grade.

Where multiple small lines are buried in a common trench and do not exceed the overall width of 16", install single line marker. For tile fields and similar installations, mark only edge pipe lines of the field.

B. Locate pipe markers, and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations. Pipe markers shall be furnished and installed in the following locations:

1. Adjacent to each valve (except valves on plumbing fixtures and equipment).
2. At each riser take-off.
3. At each pipe passage to underground.
4. Near each branch, excluding short take-offs for fixtures; mark each pipe at branch, where there could be question of flow pattern.
5. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures, marked on both sides of the structure.
6. At access doors, manholes and similar access points which permit view of concealed piping.
7. Near major equipment items and other points of origination and termination.
8. Spaced intermediately at maximum spacing of 40' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment, within 4' of exit or entrance to a vessel or tank.

3.3 VALVE TAGS

A. Brass tags shall be attached to the valves with brass "S" hooks and brass jack chain.

3.4 NAME PLATES

A. Name plates shall be securely affixed in a conspicuous location to each piece of equipment.

B. The following shall be provided with equipment name plates:

1. Fan Coil Units (all types)
2. Rooftop Units
3. Heat Recovery Units
4. Dedicated Outdoor Air Systems
5. Make-Up Air Units
6. Condensing Units (all types)
7. Ductless Split Systems
8. Fans
9. Electric Heaters
10. Gas-Fired Heaters
11. Water Heaters
12. Recirculating Pumps
13. Pool Pumps
14. Control Panels

3.5 VALVE CHARTS

A. A valve chart framed under glass and wall mounted shall be provided, which shall list each valve by number, its location in the piping system (including pipe line such as domestic cold water, domestic hot water and recirc water, and associated piece of equipment such as pumps and water heaters), and its function (shut-off, balancing, drain or quick-fill). Valve chart shall be mounted in the Main Mechanical Room.

3.6 EQUIPMENT LABELS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual unit number as well as service (Refer to the mechanical and plumbing drawings for the associated equipment schedules and match the associated equipment designations as applicable). Include the apartment number served in all equipment identification.

B. Each item of equipment shall be permanently labeled with a nameplate of sufficient size to clearly indicate the identification designation (i.e., equipment number) appearing on the Contract Document. Nameplates may be 1/16" thick bakelite laminate (engraved with letters through black), or aluminum with black enameled surface, with engraved letters. Handwritten marker identifications are not acceptable.

3.7 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this Division or other Divisions.
B. Cleaning: Clean face of identification labels on various devices, and glass frames of valve charts.

3.8 EXTRA STOCK

A. Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

1. Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in extra stock, along with required stock of stenciling paints and applicators.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING AND BALANCING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section specifies the requirements and procedures total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. Test, adjust, and balance the following mechanical systems:

1. Airside systems: Supply air, return air, relief air, exhaust air, and outside air systems; economizer systems; verify temperature control systems operations.
2. Waterside systems: chilled water, recirculating pump, pool pump(s).

C. This Section does not include:

1. Specifications for materials for patching mechanical systems; specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

1.2 SCOPE OF WORK

A. A Test and Balance Agency that is independent of any contractor or manufacturer shall perform the testing, adjusting and balancing and prepare reports, and deliver them to the Architect. The independent Test and Balance Agency shall be a certified member of the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB) unless approved after thorough review of: “prior approval” qualifications before project bid. The Test and Balance Agency contract shall not be assigned to any Subcontractor; the Agency shall work directly under the General Contractor, with no exceptions.

B. Total System Balance shall be performed in accordance with the AABC National Standards, for Total System Balance, and in accordance with the scope of work defined by the Contract Documents.

C. Testing and Balance Agency as part of its contract shall act as an authorized inspection agency, responsible to the General Contractor, and shall, during the test and balance, list systems that are installed incorrectly, require correction, or have not been installed in accordance with Contract Drawings and Specifications.

D. Upon the completion of the test and balance work, the Agency shall compile the test data and submit the specified number of copies of the complete report to the General Contractor for submitting to the Owner's Representative for evaluation and approval, refer to Section 23 05 01. Preferred submission is electronic in .pdf format.

E. Test, adjust and balance the HVAC air systems. After testing, adjusting, and balancing is complete, the Agency shall visit the job during the heating cycle and during the cooling cycle to make adjustments to provide uniform temperatures throughout the building. Schedule the trips sometime during the months of December through February for the heating cycle, and June

through August for the cooling cycle. Obtain signed statements from the Owner acknowledging these two trips and subsequent adjustments. Submit statements to the Architect/Engineer through the General Contractor indicating the findings. The Agency shall also coordinate with the Contractor and Commissioning Agent (CxA) as required to assist in the commissioning of the building systems or as required for the CxA to witness test and balance procedures. Refer to the specifications regarding commissioning for additional information.

1.3 DEFINITIONS

A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

1. The balance of air distribution systems;
2. The balance of the chilled water system (only system applied to the design);
2. Adjustment of total system to provide design quantities;
3. Electrical measurement;
4. Verification of performance of all equipment and automatic controls

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns as applicable at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

F. Report Forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets and return outlets on air terminals and exhaust or return inlets on air terminals such as fans, rooftop units, registers, grilles, diffusers and louvers.

H. Main: Duct containing the system's major or entire air or water flow.

I. Submain: Duct containing part of the systems' capacity and serving two or more branch mains.

J. Branch Main: Duct serving two or more terminals or units.

K. Branch: Duct serving a single terminal or unit.

1.4 SUBMITTALS

A. Agency Data:

1. Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

B. Certified Representative and Technicians Data:

1. Submit proof that the Test and Balance certified representative assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

C. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

D. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in maintenance data specified in Section 23 05 01.

E. Sample Forms: Submit sample AABC or NEBB forms.

F. Certified Reports: Submit testing, adjusting, and balancing reports bearing the certified seal and signature of the Test and Balance representative. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

1. Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 3 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 4 complete sets of final reports.
3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:
    a. General Information and Summary
    b. Air Systems
    c. Water Systems
    d. Temperature Control Systems
    e. Sound Measurements on each floor near corridor supply duct riser areas, the Ground Floor main lobby, multipurpose room, gallery, and meeting room
4. Report Contents: Provide the following minimum information, forms and data:
    a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Owner, Owner's Representative, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance registered representative. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.
    b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

G. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.5 QUALITY ASSURANCE

A. Agency Qualifications:

1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems specified to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. The independent testing, adjusting, and balancing agency certified by Associates Air Balance Council (AABC) or NEBB in those testing and balancing disciplines required for this project, and having at least one registered in the State in which the services are to be performed, certified by AABC or NEBB as a Test and Balance representative.

C. Codes and Standards:

1. AABC: "National Standards for Total System Balance".
2. ASHRAE: ASHRAE Handbook, HVAC Applications, Testing, Adjusting, and Balancing.

1.6 FINAL INSPECTION

A. All systems, when completed, shall be operated by the organization to test the performance as directed by and to the satisfaction of the Owner.

B. Systems shall be balanced within the stated tolerances at the design conditions. The Owner's Representative may request or perform a check reading on up to 10 per cent of the outlets and duct traverses. If any reading varies beyond the stated tolerances, the system will be considered out of balance and the entire system be readjusted and a new report prepared at no additional cost to the Owner.

C. Heating, ventilation and air conditioning systems shall maintain uniform temperatures without drafts through the normal change of seasons. The Owner's Representative may request new design settings on up 20 per cent of the air outlets and coil connections for final adjustment of the system during the first year of operation at no additional cost to the Owner.

D. Air ducts shall circulate air without excessive noise.

E. All defects demonstrated by inspections and tests shall be remedied immediately to the satisfaction of the Architect, Engineer and Commissioning Agent.

F. Coordinate with the Commissioning Agent and Architect/Engineer, as required, for their observance of any specific witnessing of the work.

1.7 PROJECT CONDITIONS

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

PART 2 – PRODUCTS

2.1 PATCHING MATERIALS

A. Except as otherwise indicated, use same products as used by original Contractor for patching holes in insulation, ductwork, and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.

PART 3 – EXECUTION

3.1 REQUIRED DOCUMENTS

A. The Contractor shall provide the following, in a timely fashion, to the Test and Balance Agency:

1. Contract drawings (complete and current set).
2. Applicable specifications (Mechanical, Plumbing and Electrical as a minimum).
3. Related addenda.
4. Related reviewed shop drawings.
5. Related reviewed equipment manufacturer's submittal data.
6. Reviewed equipment control drawings.
7. Related responses to Requests for Information (RFI’s).
8. Related change orders.

3.2 COOPERATION

A. The General Contractor and his subcontractors shall cooperate fully with the Test and Balance Agency and provide:

1. Completely operable systems.
2. The right to adjust the systems.
3. Access to systems components.

3.3 BELT DRIVES

A. Adjustable speed drives are to be adjusted by the Test and Balance Agency. In cases where the specified capacities cannot be obtained with the original adjustable sheave or original fixed drive sheave, the Agency is to report to the Contractor the sheave size required to obtain the specified capacity.

B. Where larger or smaller sheave sizes are required, the Contractor shall provide new sheaves and, if required, and new belts at no additional cost to the Owner.

C. If equipment performance is less (more than 10% low) than the submitted approved shop drawings indicate or capacities as shown on the drawings, the Contractor shall change out motors, fan sheaves, belts and any electrical circuiting changes required to upgrade the equipment to increase flow to meet the Contract Documents, at no additional cost to the Owner.

3.4 OPERATING TEST

A. A complete system operating test, with the Commissioning Agent, shall be made with controls set in their various positions to insure proper operation under the design conditions. All tests and final adjustments shall be made to the complete satisfaction of the Commissioning Agent, Architect/Engineer and Owner.

3.5 CONTROL PERFORMANCE CHECK

A. The results produced by the operation of rooftop and fan systems controls shall be checked by the testing agency; controls requiring adjustment shall be listed and reported to the Contractor. This does not reduce the responsibility of the Contractor for the checking and adjustment required for a fully operational control system. The Test and Balance Agency is responsible only for final settings; the Contractor is responsible for completeness and correctness of all the control systems.

3.6 SETTINGS

A. The Test and Balance Agency shall permanently mark the settings of all dampers, valves and other adjustment devices in a manner that will allow the settings to be restored. If a balancing device is provided with a memory stop, it shall be set and locked.

3.7 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform these steps unless noted below to be performed by the Contractor:

1. Before any adjustments confirm that air units' supply and return flowrates are as specified through a duct traverse prior to any adjustment of flow regulating devices.
2. Compare design to installed equipment and field installations.
3. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
4. Check filters for cleanliness.
5. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
6. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
7. Determine best locations in main and branch ductwork for most accurate duct traverses.
8. Place outlet dampers in the full open position.
9. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
10. Verify that all motors and bearings have been lubricated by the Contractor prior to testing, adjusting, and balancing.
11. Check fan belt tension.
12. Check fan rotation.

3.8 MEASUREMENTS

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

E. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

F. Take all reading with the eye at the level of the indicated value to prevent parallax.

G. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

H. Take air, electrical etc. measurements in the system where best suited to the task.

I. Sound measurements shall be made in corridor near core areas on floors 2 thru 5 of Mill 3. Readings shall be taken in the 8 Octave bands and plotted on N.C. curves and submitted in the report with all mechanical systems operating.

J. Adjust flow-measuring devices installed in water mains and branches to design water flows.

1. Measure flow in main and branch pipes.
2. Adjust main and branch balance valves for design flow.
3. Re-measure each main and branch after all have been adjusted.
4. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
5. Perform temperature tests after flows have been balanced.

3.9 PERFORMING TESTING, ADJUSTING, AND BALANCING

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. Cut insulation and ductwork, for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts, and test for and repair leaks.

E. Seal insulation to re-establish integrity of the vapor barrier.

F. Mark equipment settings, including damper control positions, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

G. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.10 RECORD AND REPORT DATA

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

3.11 REPORT

A. The following items shall be tested, recorded, and incorporated in the test and balance report. The report shall not be limited to these items, but shall include these tests as minimum requirements:

1. Record each equipment manufacturer, model numbers and serial numbers.
2. Test, adjust and record required and measured total CFM for each air system and component. Test and record quantity of exhaust or relief air in CFM.
3. Test, adjust and record all required and measured outside air quantities and return air CFM.
4. Test and record required and measured system static pressures; filter differential, air coil differential, and fan total static pressure. Test and record water pressure drop through the water coils and air system units.
5. Record all installed fan drive assemblies; fan sheaves, motor sheaves, and belts.
6. Record each installed motor manufacturer.
7. Record each installed motor horsepower.
8. Test and record each motor name plate and measured voltage and full load amperage.
9. Test, adjust, and record each blower RPM.
10. Test and adjust the CFM delivery of each diffuser, grille, and register including all guest room toilet exhaust.
11. Identify the location of each diffuser, grille, and register.
12. Record the size, type, and manufacturer of each grille, register and diffuser.
13. Data obtained for each diffuser, grille and register shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
14. All diffusers, grilles, and registers shall be adjusted to minimize drafts.
15. All tests shall be made with supply, return, relief and exhaust systems operating, and all doors, windows, etc. closed or in their normal operating condition.
16. All damper positions shall be permanently marked after air and water balancing is complete.
17. The final balanced condition of each area shall include the testing and adjusting of pressure conditions. Front doors, exits, etc., should be checked for air flow so that exterior conditions do not cause excessive abnormal pressure conditions.
18. Indicate on floor plans the locations and results of the sound measurements taken.
19. Test, adjust, and record each sump pump suction and discharge pressure, shut-off pressure, flow, model number, serial number, manufacturer, impeller diameter, and motor information.
20. Water flow rate in gpm.
21. Water pressure differential in feet of head or psig.
22. Entering-water temperature in deg F.
23. Leaving-water temperature in deg F.

3.12 SYSTEM BALANCING REQUIREMENTS

A. Testing, adjusting and balancing shall be provided for all airside and waterside systems and equipment specified and indicated in the Contract Documents.

3.13 DEMONSTRATION TRAINING

A. Train the Owner's maintenance personnel on operation and troubleshooting procedures and testing, adjusting, and balancing procedures. Review with the Owner's personnel, the information contained in the Operating and Maintenance Data specified in Section 23 05 01.

B. Schedule training with Owner's with at least seven (7) days prior notice. Submit a copy of the training completion to the Architect/Engineer.

END OF SECTION 230593

SECTION 230713 - DUCTWORK, PIPING AND EQUIPMENT INSULATION

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of mechanical insulation required by this section is indicated on drawings and schedules, and by requirements of this section. All mechanical and plumbing equipment and materials with cold (below 65 degrees) or warm (above 90 degrees) surfaces shall be insulated; any equipment or materials noted in these specifications shall be insulated.

B. Types of mechanical insulation specified in this section include the following:

1. Fiberglass: Insulation for Ductwork Systems, all interior above ground plumbing water piping, all branch arm waste piping from electric drinking fountains and "P" traps from handicap lavatories, horizontal storm piping, roof drain bodies, and domestic water.
2. Flexible elastomeric piping insulation: Insulation for ALL refrigerant and above grade interior condensate piping.
3. Inserts at domestic hot and cold water and horizontal storm piping.
4. Chilled water piping insulation: Insulation for ALL chilled water interior piping.
5. Grease Hood Ducting Insulation: Insulation for ALL grease ductwork.

C. Refer to specification Section 23 31 13, for insulation requirements for flexible ductwork and lined ductwork.

1.2 QUALITY ASSURANCE

A. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, unless otherwise noted, as tested by ASTM E 84 (NFPA 255) method.

B. UL Compliance: Comply with UL181 and UL723.

C. NFPA Compliance: Comply with NFPA 90 A.

D. Installation shall be installed by quality skilled workmen only with a minimum of 5 years' experience, regularly engaged in performing industry standard insulation installation.

E. All thermal insulation material furnished and installed under this section of these specifications shall be new and in first class condition. Insulation materials that have become wet or contaminated shall not be installed.

F. All thermal insulation material furnished and/or installed by Contractor found to be in non-compliance with these specifications or damaged shall be removed and replaced with materials complying with this section of these specifications at Contractor's expense.

G. Materials shall be applied subject to their temperature limits. Any methods of application of insulating materials or finishes not specified in detail herein shall be in accordance with the particular manufacturer's published recommendations.

H. Material shall be furnished to the job bearing the manufacturer's label.

I. Vapor barriers shall have perm rating not to exceed 0.05 perms.

J. Materials containing asbestos or any trace of asbestos related materials shall be prohibited from use in any portion of this project.

1.3 SUBMITTALS

A. Product Data – Submit manufacturer's technical data, specifications, installation instructions, and thermal conductivity ratings.

B. Shop Drawings – Include an insulation schedule indicating insulation material, thickness, insulated components, etc.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver material to job site in new, undamaged condition. Wet and/or contaminated insulation shall not be permitted for use.

B. Store insulation utilizing suitable means so as to protect from weather, construction work traffic and contamination. Insulation shall not be stored outdoors under any circumstances. Contractor shall cover stored insulating materials to prevent damage from water or contamination.

C. Do not store materials in building until it is enclosed and dry. Wet insulation shall not be installed and shall be removed from the job site at the Contractor's expense.

D. All thermal insulation material installed by Contractor found to be contaminated or have been wet shall be removed and replace with materials complying with this section of these specifications at Contractor's expense.

PART 2 – GENERAL

2.1 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fiberglass, reformed fittings and PVC jackets products which may be incorporated in the work include the following:
1. Armstrong
2. Certainteed
3. Johns Manville
4. Owens-Corning
5. Rubatex
6. Zeston

B. Foamed plastic sheet, tubing and tape manufacturers:
1. Armaflex
2. Halstead
3. Kavco
4. Rubatex

C. Adhesives, mastics and coatings manufacturers:
1. Armaflex
2. Armstrong
3. Benjamin Foster

4. Childers
5. Epolux
6. Foster
7. Marathon Industries
8. Minnesota Mining and Manufacturing
8. Vimasco

D. High temperature insulation manufacturers:
1. Armstrong
2. ETS Schafer
3. Thermal Ceramics
4. Vesuvius USA

2.2 PIPING INSULATION MATERIALS

A. Fiberglass Piping Insulation: ASTM C 547, Class 2 rated to 650°F, ASTM C 335 thermal conductivity K=0.26 AT 75° F mean temperature, with Kraft-reinforced foil all-service vapor retarder jacket. The longitudinal lap joint of the jacket shall have a pressure sensitive tape lap sealing system. Provide Armafix IHP inserts or Foam-Glas inserts at hangers.

B. Flexible elastomeric piping insulation: AP Armaflex Black Lapseal with Microban, pipe or sheet covering, or an approved equivalent, by listed manufacturer. The insulation shall have a thermal conductivity not to exceed 0.25 Btu/hr-sq.ft. at a mean temperature of 75°F per ASTM C177 or C518. Insulation shall be ASTM E 84 rated for a flame spread of 25 and smoke developed of 50. Insulation shall resist chemicals, solvents, weather, rodents, vermin and fungus.

C. Chilled water piping insulation: preformed closed cell polyisocyanurate pipe insulation with a maximum thermal conductivity (k) of 0.20 and vapor retarder cover (Dow Trymer with Saran cover or equivalent), butt joints and tape. Provide Foam-Glas inserts at hangers. Insulation thickness shall be 1.5" for all pipe diameters per IECC 503.2.8.

D. Insulation shall be provided for pipe sizes as indicated in the following table:

Piping System	Temp. Range	< 1”	1” to < 1-1/2”	1-1/2” to < 4”	4”+
Domestic HW and Recirc	105+	1/2”	1/2”	1”	1”
Refrigerant; Domestic CW	All	1/2” (3/4” *)	1”	1”	1”
Chilled Water	All	1-1/2”	1-1/2”	1-1/2”	1-1/2”
Handicapped Lavatory Waste	All	1/2”	1”	1”	1”
Horizontal Drinking Fountain Waste	All	1/2”	1/2”	1/2”	1/2"
Condensate Drain	All	1/2”	1/2”	1”	1”
Horizontal Storm within bldg (normal and emergency)	All	1”	1”	1”	2”

(* for outdoor refrigerant piping)
Note; CPVC COLD WATER piping within the conditioned space may be installed without insulation.

E. Inserts: Provide pipe insulation inserts at all pipe hangers on all piping for sizes 2” and larger the same thickness as the pipe insulation, but a minimum of 1.5” thick, or larger as required to match the adjacent pipe insulation thickness, unless otherwise noted in Section 23 05 29.

F. Fittings, flanges, valves and pipe terminations shall be insulated by applying the proper precut insulation insert to the pipe fitting. Insulation shall have a thermal conductivity K=0.28 at 75°F mean temperature.

G. Encase pipe fittings with fiberglass insulation in one-piece pre-molded Zeston 2000 PVC fitting covers, NFPA 90A rated, fastened as per manufacturer's recommendations, and joints covered with mastic including all fasteners.

H. Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated for standard installation.

I. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated. All insulation materials shall be fire retardant and low VOC.

2.3 DUCTWORK INSULATION MATERIALS

A. Duct Wrap Insulation: Moisture absorption less than 3% at 120°F and 90% relative humidity per ASTM C 553; Type 1, Class B-3, fiberglass flexible type, 1" thick, 1.5 lb. per cu. ft. density, thermal conductivity K=0.27 at 75°F mean temperature, and minimum R-3.5 (ASTM C 518), 250°F operating temperature limit per ASTM C 411.

B. Jackets for Duct Wrap Insulation: ASTM C 921, Type 1, factory applied reinforced foil-faced flame resistant Kraft paper vapor barrier.

C. Ductwork Insulation Accessories: Provide bands, 16 gauge annealed steel wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

D. Duct Liner: Provide 1” thick closed cell elastomeric foam insulation, permeated with an anti-microbial agent, with a self-adhesive internal surface in contact with the ductwork interior, and a maximum thermal conductivity K=0.25 at 75°F mean temperature. Insulation shall be Armacell AP/Coilflex with Microban, with all joints and seams sealed with Armaflex 520 adhesive, or equivalent.

E. All exterior HVAC ductwork shall be internally lined and externally insulated with two (2) layers 2” thick insulation with a maximum thermal conductivity K=0.23. Minimum R-6.0 insulation value. See project details for additional information. Provide thin sheet-type aluminum jacketing with self-adhesive backing. Lap jacket to create "drip edges" at all joints and seams to prevent entrance of water. Seal all joints and seams waterproof with silicon sealant.

F. All HVAC ductwork located in unconditioned space shall be internally lined and externally insulated with insulation with a minimum R-8.0 value.

G. Grease Hood Ducting Insulation: Insulate ducting with a blanket insulation designed to be applied directly to grease ducts and permit zero clearance to adjacent combustible surfaces. Provide one or two layers of 1-1/2” or 2” thick wrapping to constitute a UL listed and ASTM tested 1 hr. or 2hr. fire rated system (2hr. unless specifically noted otherwise). The layers are to be applied in accordance

with the manufacturer's recommendations, with all strapping bands to be stainless steel. Acceptable products: Vesuvius USA Corp. ("Pyroscat FP or CSM" Duct Wrap), Thermal Ceramics, Inc. ("Firemaster" Duct Wrap), or ETS Schafer ("Flameshield or FSB" Duct Insulation) or equivalent approved by the LAHJ as manufactured by Nelson Firestop ("FSB Flameshield Blanket"), Certainteed ("FlameCheck"), or Armstrong.

2.4 ADHESIVES, MASTIC AND COATING MATERIALS

A. Adhesives, Mastic, and Coatings: All items inside the building shall be "low VOC" type materials.

B. Treatment of pipe jackets and duct facings to impart flame and smoke safety shall be permanent. The use of water-soluble treatments is prohibited.

C. Vapor barriers shall be continuous and have a perm rating of not more than 0.05 perms. Adhesives, coatings and mastics shall have a perm rating of not more than 0.25 perms.

D. Tape: Wherever tape is used for sealing purposes, it shall be of the type, and applied, as recommended by the non-conductive covering manufacturer. Where recommendation is lacking, the tape used shall be sealed with Minnesota Mining Adhesive EC-1329.

E. Insulating Cement: 0-C 110 mineral wool, Benjamin Foster or Minnesota Mining, all purpose cement. Where insulating cement is applied to pipe fittings in concealed locations, it shall be "one-coat" cement.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 GENERAL

A. The application of insulation shall be subject to the inspection and approval of the Owner's Representative.

B. Surfaces to be insulated shall be clean, dry, and free of foreign material, such as rust, scale and dirt when insulation is applied. Pressure tests shall be performed as required by other Sections before applying insulation.

C. Insulation of items such as valves, controls, access doors, specialties and accessories shall be installed to allow for ready accessibility for servicing, operating, maintaining and repairing.

D. Insulation shall be applied with a continuous, unbroken vapor seal. Hanger, supports, anchors, etc. that are secured directly to hot or cold surfaces shall be adequately insulated and vapor sealed to prevent condensation.

E. Install insulation products in accordance with manufacturer's written instructions, recognized industry practices, and the requirements herein providing the most stringent application specified to ensure that insulation serves its intended purpose.

F. Perform successful piping pressure tests required by other Sections before applying insulation.

G. Insulate completely all metal surfaces of piping, ductwork, and equipment other than hangers.

3.3 PIPING SYSTEMS INSULATION

A. General:

1. Extend piping insulation, jackets and coatings without interruption through walls, floors and similar piping penetrations, except through fire walls.
2. Insulate pipe, fittings, flanges, unions, grooved couplings and valves (including bonnets).
3. Care shall be taken so as not to place insulation over vent and drain inlets and outlets.
4. Staples are not permitted on pipe insulation.
5. Install clean and dry insulation on pipe systems subsequent to painting, testing, and acceptance of tests.
6. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
7. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.
8. Cover valves, fittings, flanges, pipe terminations and similar items in each piping system with the equivalent thickness of precut insulation inserts as the thickness of insulation applied to adjoining pipe run. The ends of the insulation shall be tucked snugly into the throat of the fitting and the edges adjacent to the pipe insulation tufted and tucked in, fully insulating the pipe fitting.
9. Provide 3/4” thick elastomeric piping insulation on the exterior surfaces of expansion tanks, pumps and fittings for which pre-formed fiberglass is not available.
10. Supports for insulated piping shall be outside the insulation. Inserts shall be provided at all hangers, refer to Section 23 05 29. Pipe shoes welded to the pipe shall be used for roll type hangers.
11. Insulation shall be installed to permit expansion and contraction without causing damage to insulation or surface finish.
12. Surface finishes shall present a tight, smooth appearance.
13. Surface finish shall be extended to protect all surfaces, ends, and raw edges of insulation.
14. All outdoor refrigerant piping insulation shall be painted with two (2) coats of insulation manufacturer’s white mastic for UV protection from sunlight.
15. All exterior uninsulated steel piping (i.e. gas, condensate, etc..) installed exposed to weather or under covered, unconditioned areas shall be painted with a rust resistant primer and a weather-proof final coat. All exposed insulated piping shall have a weather-proof jacket for non-water proof insulation systems or the insulation shall be painted with a UV resistant paint for water proof insulation systems.

B. Fiberglass Insulation:

1. Butt all joints of pipe insulation together and secure all jacket laps with lap adhesive. Seal all butt joints with 3" wide self-sealing pressure sensitive tape furnished with insulation. Longitudinal joints shall be sealed with the pressure sensitive sealing system provided with the pipe insulation jacket.
2. An approved vapor retarder mastic compatible with the PVC covering shall be applied around the edges of the adjoining pipe insulation and on the fitting cover throat overlap seam. The Zeston 2000 PVC fitting cover shall then be applied and secured with 3" wide self-sealing pressure sensitive tape along the circumferential edges. The tape shall extend over the adjacent pipe insulation and have an overlap on itself at least two inches on the downward side.

3.4 DUCTWORK SYSTEMS INSULATION

A. Duct wrap insulation shall be provided on all unlined supply, return and make-up air ductwork, and at all roof drain bodies within the building envelope.

B. All return air, relief air, and transfer air ductwork shall be lined. Supply air ductwork shall be lined from air handling equipment (RTU, AHU, FCU, Fan, etc.) discharges through the first horizontal elbow or through the first twelve (12) feet, whichever is greater. All new low pressure supply air ductwork serving conference type areas (meeting, conference, training rooms, etc.) shall be lined. Sizes indicated on drawings are clear inside dimensions available for air flow; add liner thicknesses to determine required sheetmetal sizes.

C. Install insulation materials with smooth and even surfaces.

D. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-barrier on ductwork insulation and protect it to prevent puncture and other damage. Seal all breaks and punctures with vapor barrier tape and fire-retardant adhesive.

F. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated, i.e. through fire walls and fire rated ceilings at fire dampers.

G. Duct Wrap Insulation: Secure insulation to ductwork, diffusers, and plenums with Benjamin Foster low VOC adhesive applied in 4-inch strips around the duct on 12-inch centers. Where ductwork is 24-inches wide or more secure insulation to the bottom of the duct using mechanical fasteners such as self-adhering pins and self-locking (speed clip) washers placed not more than 15-inches on center. Pins shall be cut close to the speed clip. Speed clips shall be drawn flush to the insulation only and not to compress insulation. Insulation shall overlap lining and factory applied insulation a minimum of 2-inches. Vapor barrier at all butted joints, breaks and over all speed clips shall be sealed with 4-inch wide foil reinforced tape adhered with Benjamin Foster low VOC adhesive.

H. All exposed insulated ductwork shall have a weather-proof jacket for non-water proof insulation systems.

3.5 EQUIPMENT

A. Clean and dry all surfaces to be insulated from loose scale, dirt, oil, water, and other foreign matter.

B. Surface finishes shall present a tight, smooth appearance.

C. Insulation shall be installed to permit expansion and contraction without causing damage to insulation or surface finish.

D. Surface finish shall be extended to protect all surfaces, ends, and raw edges of insulation for a complete vapor barrier.

E. Insulation and vapor barrier shall be continuous and uninterrupted through wall, ceiling, floor

openings, roof openings and sleeves, except where fire dampers or fire/smoke dampers occur.

3.6 CLEANING

A. At the time scheduled for final inspection, the finished surface of all exposed insulation shall be clean without any stains or blemishes. If necessary to obtain a new appearance, the contractor shall coat any discolored sections with off white latex base water mix semi-gloss paint or lagging adhesive at no cost to the Owner.

3.7 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including sections with vapor barrier damage and moisture saturated sections at no additional cost to the Owner.

B. Protection: Protect insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 230713

SECTION 230933 – DIRECT DIGITAL CONTROL (DDC) SYSTEM

PART 1 - GENERAL

1.1 CONTROL SYSTEMS DESCRIPTION

A. The Building Automation System shall be as indicated on the drawings and described in these specifications. System must be fully integrated and coordinated with mechanical equipment DDC controllers furnished and installed in the equipment manufacturer's factory as specified in those sections. The intent of the BAS is to integrate all mechanical equipment into one system for global monitoring, control, and alarming associated with the building. It is the BAS manufacturer's responsibility to provide all the design, engineering, and field coordination required to ensure all equipment sequence of operations are met as specified and the designated BAS operators have the capability of managing the building mechanical system to ensure occupant comfort while maintaining energy efficiency. This Contract is for all materials, labor, supervision, services, tools, equipment, equipment transportation, and other items required for the construction of the automatic temperature controls. Coordinate closely with the Mechanical and Electrical Drawings.

B. The BAS shall meet BACnet communication standards to ensure the system maintains "interoperability" to avoid proprietary arrangements that will make it difficult for the Owner to consider other BAS manufacturers in future projects.

C. BAS controllers shall be listed by BACnet Testing Laboratories (BTL) with appropriate classification.

1. System controller shall be BTL listed BACnet Building Controller (B-BC).

2. Equipment Controllers shall be BTL listed BACnet Application Specific Controller (B-ASC) or BACnet Advanced Application Controller (B-AAC), as appropriate for the purpose of the controller.

D. The controls system may be referred to in this and other specification sections as Building Controls System (BCS), Building Management System (BMS), Energy Management System (EMS), Automatic Temperature Controls System (ATC), or other similar terms; all of which refer to the single central controls system.

E. Direct Digital Control (DDC) "open-protocol" type technology shall be used to provide the functions necessary for control of mechanical and electrical systems on this project.

F. The Building Controls System shall monitor and control all HVAC equipment and systems (except where specifically noted otherwise), plumbing water heating and pumping equipment and controls, and shall fully interface with the fire alarm system and lighting controls system, and shall be capable of full integration with the security system.

G. The control system shall be UL listed specifically for operation of HVAC equipment and systems associated with life safety functions in conjunction with and as a fully integrated component of the fire alarm system. Life safety systems function control shall include all equipment (Fans, DOAS's, ERU's, AHU's, FCU's, HPU's, PIU's, VAV's) and dampers (FSD's, MOD's) associated with operation of the stair pressurization and smoke management (both exhaust and make up air) systems.

H. The controls system shall be fully accessible via password secured high speed internet interface.

I. The control system shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by operator password. Multiple users shall have access to all valid system data. An operator shall be able to log onto any work-station on the control system and have access to all appropriate data.

J. The control system shall be designed such that each mechanical system will be able to operate under stand-alone control. As such, in the event of a network communication failure, or the loss of any other controller, the control system shall continue to independently operate under control.

K. Communication between the control panels and all work-stations shall be over a high speed network. All nodes on this network shall be peers. The operator shall not have to know the panel identifier or location to view or control an object. Application Specific Controllers shall be constantly scanned by the network controllers to update point information and alarm information.

L. The system shall be fully capable of operator monitoring and control of all sensors, set points, equipment and dampers completely through a dynamic graphical interface, in addition to via written programming. The intention is to allow the building engineer to quickly navigate through the buildings mechanical system from a large-scale overview (building elevation) to the floor plan and down to the equipment level. All relevant equipment and component shall be represented so as to illustrate the system component interactions.

1.2 RELATED DOCUMENTS

A. Description: All work specified in this Section is subject to the provisions of Section 23 05 00. See other sections of the project specifications that may apply to components or accessories related to this installation.

B. Work by Others: The Electrical Contractor shall install and connect all power wiring.

1.3 APPROVED CONTROL SYSTEM MANUFACTURERS

A. Automated Logic

B. Johnson Controls

C. Trane

1.4 QUALITY ASSURANCE

A. System Installer Qualifications:

1. The Installer shall have an established working relationship with the Control System Manufacturer of not less than five years.
2. The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.
3. The installer shall have an office within 50 miles of the project site and provide 8 hour response in the event of a customer call.

B. All equipment furnished and installed under this section of these specifications shall be new and in first class condition.

C. All equipment furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor's expense.

D. Codes and Standards:

1. UL Compliance: Units shall be designed in accordance with UL Standard 916-PAZX.
2. ASHRAE: Unit and controls designed to conform to ASHRAE Standard 135.
3. All wiring shall be in accordance with the National Electric Code (NEC) – NFPA 70.

E. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

F. Installation, Operation and Maintenance manual with startup requirements shall be provided.

G. Spare parts shall be available for at least 5 years after completion of this contract.

1.5 SUBMITTALS

A. Contractor shall provide shop drawings and manufacturers' standard specification data sheets on all hardware and software to be provided. No work may begin on any segment of this project until submittals have been reviewed by the Engineer for conformity with the plan and specifications. Six (6) copies are required. All shop drawings shall be done on AutoCAD, and provided to the Owner on a CD-ROM.

B. Project Record Documents: Upon completion of installation submit three (3) copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and include:

1. Testing and Commissioning Reports and Checklists.
2. Operating and Maintenance (O & M) Manual - These shall be as-built versions of the submittal product data.

C. Training Manuals: The Contractor shall provide a course outline and training manuals for all training classes at least six weeks prior to the first class for review by the Engineer and the Commissioning Authority. Contractor shall incorporate any review comments into the training documentation and classes issued by the Engineer and Commissioning Authority. The Owner reserves the right to modify any or all of the training course outline and training materials. Review and approval by Owner and Engineer and shall be completed at least 3 weeks prior to first class.

1.6 TRAINING

A. Provide 40 hours of training for owner/operator maintenance personnel prior to completion and owner acceptance.

1.7 WARRANTY

A. Warrant all work as follows:

1. Labor & materials for control system specified shall be warranted free from defects for a period of twelve (12) months after final completion acceptance by the Owner. Owner acceptance shall be defined as the time upon which fully operation control system can be demonstrated and owner training completed; not at start up of systems. Control System

failures during the warranty period shall be adjusted, repaired, or replaced at no charge or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 8 hours.

1.8 OWNERSHIP OF PROPRIETARY MATERIAL

A. All project developed hardware and software shall become the property of the Owner. These include but are not limited to:

1. Project graphic images
2. Record drawings
3. Project database
4. Job-specific application programming code
5. All documentation.

1.9 SCOPE

A. The scope of the automatic controls building management system (BMS) includes a state-of-the-art, full direct digital controls (DDC) system to monitor and control all components of the mechanical system as indicated in the Sequence of Operations in this section as well as capability for interface with the Fire Alarm and Life Safety system and the Lighting Control System via BACnet.

B. The automatic temperature controls shall be provided by the controls Contractor with all components such as direct digital controllers and panels, electronic time clocks, junction boxes, control panels, sensors, etc. (those not provided with the their equipment) mounted, wired and tested.

C. In addition to the capabilities listed in the Sequence of Operations, the system shall have the logic capability for historical data storage and trend logging, equipment operation optimization, maintenance management, individual tenant energy usage monitoring and billing summary reporting.

D. The system shall also be required to provide full integration capabilities with the other building systems via standardized protocol including the security system, hotel telecommunication systems, elevator management systems, landscape irrigation, audio/visual systems, hotel guest room management systems, hotel point of sale systems, and the food and beverage systems. Some of these systems are not yet designed, however, that does not relieve the contractor from being required to provide this capability. The system shall allow access through integration to all of these systems from any PC within the building and connected to the local area network. The system shall provide for user ID and password assignments with no limitation on the number of total users allowed. The system shall provide for both monitoring capabilities over all of these systems as well as operational control. Failure to provide this requirement will require replacement at the contractor’s expense.

E. Provide (furnish and install) all devices such as temperature sensors and thermostats (those not provided with their equipment), humidistats, time clocks, power supplies required for control equipment and components, control transformers, transformer relays, start-stop push buttons, relays, air/water flow and pressure switches. Temperature sensors, thermostats, flow switches, etc. shipped loose with their equipment such as air handling units, etc. shall be installed by the controls Contractor. Furnish firestats and smoke detectors where required to the mechanical contractor for his installation and install the wiring interlocks with the air units control system for local shutdown control.

F. Provide power supply wiring and conduit from 120 volt toggle switch to power connection on

controls, unit panels, control transformers including terminations. All DDC panels shall be on emergency power.

G. Provide wiring with conduit for any remote start/stop switches and manual or automatic motor control devices installed in mechanical, electrical closets/rooms and for all controls for the life safety system.

H. Provide interlock and control wiring with conduit between electrically-operated equipment units and devices such as smoke detectors, starters, fire alarm system, etc.; and between equipment and field-installed control devices. Smoke detectors shall be hard wired to the equipment starters for direct shut down upon activation of detectors. Provide all control wiring and conduit (or plenum rated cable above ceilings except for life safety system controls) from temperature sensors, thermostats, etc. to the devices they control or interface with. Interconnecting wiring and conduit (conduit is required only in exposed areas of mechanical, electrical closets/rooms and all life safety system controls) between all required devices shall be provided. Refer to electrical specifications for wiring requirements.

I. Provide control panels required including wiring and conduit from the control components to these panels with terminations completed. Control panels shall have numbered terminal strips with no smaller than #18 AWG 600 volt insulated copper conductors. Control wiring shall be no smaller than #16 AWG 600 volt insulated copper conductors and DDC wiring shall be no smaller than #20 AWG copper insulated conductors.

J. Provide control wiring with conduit (conduit is required only in exposed areas of mechanical and electrical closets and rooms, however, all control wiring for life safety systems shall be in conduit no matter what location installed) from the control devices to the local control panels (local programmable control modules located at each air handling unit, other types of required control interface modules, etc.), outside air temperature and humidity sensors shall be interfaced with for this work, from indicating devices and unit controllers.

K. Field label all control wiring circuits (control and power), sensors, thermostats, smoke detectors.

L. Provide the engineering, calibration, and checkout necessary for a complete and fully operational control system. This includes updating and modifying the existing control system during the phasing of the work.

M. Coordinate location of components and devices with the mechanical and electrical contractors.

N. Submit product data, control diagrams, component set points, sequences of operation, Operating and Maintenance Manuals, Record Drawings indicating "as-built" conditions and system start-up reports.

O. Provide services required during the guarantee period such as servicing and adjusting controls for safe, stable operation with change of seasons; making changes in control devices including removal, replacement and installation as necessary to provide safe, stable operation and maintain sequence of operation.

P. Provide pre-operational testing and commissioning as required for all controls to be operating properly prior to performing all sequences of operations for the Commissioning Authority.

Q. Verify equipment components, and interconnecting wiring installation are checked for proper connection and termination prior to mechanical system start-up. Submit written verification to the Engineer that these items are installed in accordance with the Contract Documents and are ready for calibration and start-up.

1.10 WORK BY OTHERS

A. Mechanical Contractor shall:

1. Furnish and install all necessary piping connections, taps, and test wells (minimum 1" with reducing bushings as required) required for flow, pressure or temperature sensing devices, meters, gauges, relief valves, etc.

2. Install motorized control dampers not provided with equipment with linkages, motor operators and hardware, and scheduled and also as indicated in Ductwork and Ductwork Accessories Specifications Sections.

3. Coordinate location of devices for installation by the controls contractor. Coordinate the installation by the controls contractor of unit panels and required accessories such as sensors, thermostats, power supplies, motors, relays, etc. that are shipped loose with mechanical equipment.

4. Assemble multiple section dampers with required interconnecting linkages, shafts and brackets and extend the required number of shafts through the ducts for externally-mounted damper motors. Jack shafts shall be assembled with sealed roller or ball bearings of stainless steel construction.

5. Install duct mounted smoke detectors, furnished by Electrical Contractor. Install wiring from the smoke detector auxiliary contacts to the air unit, fan, etc. motor starter for fan shutdown interface.

6. Verify all equipment for mechanical systems and components installed by the controls Contractor are checked for proper connection and termination prior to mechanical system start-up. Submit written verification to the Engineer that these items are installed in accordance with the Contract Documents and are ready for calibration and start-up.

7. The Electrical Contractor shall install and connect all end devices as follows:

   a. Power supply wiring and conduit from electrical panel power source to power connection toggle switch on controls units and junction boxes near control equipment. Include disconnects, starters, combination starter/disconnects and required electrical devices, except where specified as furnished or factory installed by the equipment manufacturer to electric motors and devices. Coordinate all devices for installation with the mechanical and controls Contractor.

   b. Emergency Power supply wiring of dedicated 120 VAC power circuits in conduit to all temperature/control panels shall be provided. Electrical and mechanical/controls contractors shall coordinate all final locations of DDC panels and install all required emergency power circuits as required for a fully operational system. As a minimum, one DDC panel shall be provided in each mechanical room.

8. Duct smoke detectors shall be furnished by Electrical Contractor installed by the Mechanical Contractor and wired to the fire alarm system by Electrical Contractor and to fan starters by the controls contractor.

B. The Electrical Contractor shall install and connect all end devices as follows:

1. Power supply wiring and conduit from electrical panel power source to power connection

toggle switch on controls units and junction boxes near control equipment. Include disconnects, starters, combination starter/disconnects and required electrical devices, except where specified as furnished or factory installed by the equipment manufacturer to electric motors and devices. Coordinate all devices for installation with the mechanical and controls Contractor.

2. Power supply wiring of 120 VAC power in conduit to all temperature control panels and time clocks.

3. Duct smoke detectors shall be furnished by Electrical Contractor, installed by the temperature controls contractor and wired by Electrical Contractor. Firestats shall be furnished, installed and wired by the controls contractor.

1.11 INSPECTION:

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. Provide pre-operational testing prior to occupancy and owner acceptance to verify that sequences of operation have been properly programmed.

1.12 SYSTEM PERFORMANCE

A. The BAS system shall conform to the following:

1. Graphic Display. The system shall display a graphic with a minimum of 20 dynamic points. All current data shall be displayed within 10 seconds of the operator’s request.

2. Graphic Refresh. The system shall update all dynamic points with current data within 10 seconds.

3. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be 5 seconds. Analog objects shall start to adjust within 5 seconds.

4. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current within the prior 10 seconds.

5. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 10 seconds.

6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.

7. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every 5 seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.

8. Multiple Alarm Annunciations. All workstations on the network shall receive alarms within 5 seconds of each other.

9. Reporting Accuracy. Table 1 lists minimum acceptable reporting accuracies for all values reported by the specified system.

a. Table 1: Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C [±1°F]
Ducted Air	±1.0°C [±2°F]
Outside Air	±1.0°C [±2°F]
Water Temperature	±0.5°C [±1°F]
Delta –T	±0.15°C[±0.25°F]
Relative Humidity	±5% RH
Water Flow	±5% of full scale
Air Flow (terminal)	±10% of reading *Note 1
Air Flow (measuring stations)	±5% of reading
Air Pressure (ducts)	±25 Pa [±0.1 "W.G.]
Air Pressure (space)	±3 Pa [±0.01 "W.G.]
Water Pressure	±2% of full scale *Note 2
Electrical Power	5% of reading *Note 3
Carbon Monoxide (CO)	± 50 PPM
Carbon Dioxide (CO2)	± 50 PPM

Note 1: (10%-100% of scale) (cannot read accurately below 10%)
Note 2: for both absolute and differential pressure
Note 3: * not including utility supplied meters

1.13 COMMUNICATION

A. This project shall be comprised of a high-speed Ethernet network utilizing BACnet/IP communications between System Controllers and Workstations. Communications between System Controllers and sub-networks of Custom Application Controllers and/or Application Specific Controllers shall be as defined below.

1. Each System Controller shall perform communications to a network of Custom Application and Application Specific Controllers using BACnet/MSTP (RS485) as defined by the BACnet standard.

a. Each System Controller shall function as a BACnet Router to each unit controller providing a unique BACnet Device ID for all controllers within the system.

1.14 CONTROLS

A. Except as noted elsewhere in this document, all air conditioning equipment controls shall have wall mounted programmable thermostats with digital readouts and adjustment buttons. The thermostats for equipment serving public areas shall have password protection and/or lockable covers.

B. All main HVAC equipment shall be provided with controls that allow remote access to monitoring of set-points, alarms, etc.

C. All exhausts serving housekeeping, trash rooms and soiled linen rooms shall operate continuously. Fans serving administrative areas not directly associated with residents may operate per switch or timeclock as applicable.

D. Provide necessary sensors and hardware required to achieve accurate temperature conditions for entering and leaving the air handling unit and communication with BMS, including but not limited to: outside air sensors, mixed air sensors, entering and leaving air temperature sensors, humidity sensors, smoke detectors, differential air pressure sensors and switches, airflow measuring stations, variable frequency drives, relays, CO2 sensors, etc.

PART 2 – PRODUCTS

2.1 SYSTEM MAIN DDC CONTROL PANEL:

A. The Main System DDC control panel shall provide complete monitoring/status and control of the mechanical system including the chilled water system (pumps, chillers, motorized valves, etc.), hot water system (boilers, pumps) through solid state controls packaged in a NEMA-1 enclosure. The panel shall have a built-in phone modem for interface via dedicated telephone line and a hard wired ethernet connection. Provide UPS (hard wired) for panel. The panel shall also have the accessibility for connection to the control system via a hand held computer terminal or laptop computer. Terminal/computer and interface software shall be provided by the Controls Contractor.

B. The Main System DDC control panel shall access information from equipment, controllers, temperature sensors, air and water flow switches, for status indication differential pressure switches, etc. field installed in the system ductwork, equipment, rooms and piping to provide signals for controlling the mechanical system such as interfacing with the air handling, DOAS Units, Kitchen Make-up Air Units and fan coil unit DDC controllers, etc.

C. The Main System DDC control panel shall monitor and control the mechanical system and provide the necessary Hardware, Software, and Network Communication abilities to provide Scheduling, Monitoring, Trending, Historical Storage, and Alarm Functions for the mechanical equipment and systems as described in this specification. Control capabilities shall include: Time of Day scheduling, Custom Control Capabilities, Logic, Optimum Start/Stop, Duty Cycling, Electrical Demand Control, Temperature Control, After Hours Override, Reports and Logs, Trend Prints, Remote Communications, Alarm Logging and Annunciation, Run Time and Maintenance, Diagnostics, and Expanded Information Messages. Visual monitoring of system and component operation shall be provided on any personal computer connected to the building LAN system including indicating status of all equipment, chilled and hot water temperatures.

D. The Main System DDC control panel shall be independent, standalone, microprocessor-based type to provide centralized control for all distributed standalone unit controllers located on each major piece of mechanical equipment. The Main System DDC panel shall communicate with mechanical unit controller, be of a modular design, allowing point expansion by the addition of universal binary and digital points on the input/output cards. Before contract award, DDC control system supplier may be required to document expansion points available in the proposed system.

E. The Main System DDC control panel memory banks shall be protected for a minimum of 30 days in the event of power failure. Internal clock shall continue to run during a power failure so that the system makes the appropriate adjustment to all connected points when power is restored. Should database be lost, provide a means of manually restoring programming from an archive copy of the data base.

F. The operating system of the Main System DDC control panel provided shall manage

communication signals, both in and out, to allow panels to share real and virtual point information with each other and to allow central monitoring, central alarms, and editing of all panels and controllers from a single operator station. The system of panels and controllers shall be programmable to autodial out upon system alarm, if required.

2.2 OPERATOR INTERFACE

A. Operator Interface. Furnish 1 PC based work-station in an approved location by the Owner (suggested to be in the facility Engineering office). The work-station shall be able to access all information in the system. These work-stations shall reside on the Enterprise wide network which is same high speed network as the building controllers. The Enterprise wide network will be provided by the owner and supports the Internet Protocol (IP). Workstations shall be web-based (standard web browser is acceptable) and also be able to be dialed into or connected to via wireless or land line modem for communication with the system from a remote location.

1. Work-station information access shall use the BACnet Protocol. Communication shall use Annex J of ASHRAE Standard 135 (latest edition). Local connections of the workstation shall be on ISO 8802-3 (Ethernet). Remote communications shall use either the BACnet Point to Point Physical/Data Link Layer Protocol or IP over Point to point (PTP).

B. Hardware. The operator work-station shall consist of the following:

1. Personal Computer. Furnish IBM compatible PCs. The operator's PC shall have a minimum capability of the following:

a. The CPU shall be a minimum of a dual core Intel Pentium processor and operate at a minimum of 2.4 GHz.

b. A minimum of 4 GB of RAM.

c. 50X read-write CD ROM drive.

d. 160 Gigabyte hard disk with a minimum access time of 12 milliseconds shall be provided.

e. A two button wireless mouse and wireless.

f. A 21" flat screen high resolution color monitor.

g. Furnish all required serial, parallel, and network communication ports, and all cables for proper system operation.

h. Two (2) USB ports

2. Portable Operator's Terminal. Furnish a Portable Operator's Terminal that shall be capable of accessing all system data. This device may be connected to any point on the system inter-network or may be connected directly to any controller for programming, set-up, and troubleshooting. BACnet. The Portable Operators Terminal shall shall use the Read (Initiate) and Write (Execute) Services as defined in Clauses 15.5 and 15.8, respectively, of ASHRAE Standard 135, to communicate with BACnet objects in the internetwork. Objects supported shall include: Analog input, analog output, analog value, binary input, binary output, binary value, device.

a. The Portable Operator's hand held Terminal shall be an IBM compatible including all software and hardware required to properly communicate with the DDC control system equipment controllers and panels.

3. All hardware and software on all devices shall be capable of dynamic point trending & analysis software, graphical time of day scheduling, Windows XP environment for simultaneous operation of multiple software programs, multiple level password access protection, and operator activity tracking.

4. Modems. Furnish high speed internet modem with Cat 6 connection and associated cables as required for communication to remote buildings, and work stations.

5. Color Printer. Ink jet type with associated cables. Each color printer shall be capable of a minimum 160 characters per second operation and be compatible with standard parallel or serial communications. Provide 2 spare black and color ink cartridges.

6. BACnet. The PCWS shall use the Read (Initiate) and Write (Execute) Services as defined in Clauses 15.5 and 15.8, respectively, of ASHRAE Standard 135 (latest edition), to communicate with BACnet objects in the internetwork. Objects supported shall include: Analog input, analog output, analog value, binary input, binary output, binary value, device.

C. System Software

1. Operating System. Furnish a commercially available, concurrent multi-tasking operating system. Acceptable operating system is Windows XP.

2. System Graphics. The Operator Work-station software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on line. An operator with the proper password level shall be able to add, delete, or change dynamic points on a graphic. Dynamic points shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation of equipment.

a. Custom Graphics. Custom graphic files shall be created with the use of commonly available graphics packages such as PC Paint. The graphics generation package shall create and modify graphics that are saved in industry standard formats such as PCX, BMP, GIF and JPEG. The graphics generation package shall also provide the capability of capturing or converting graphics from other programs such as Designer, or AutoCAD.
b. Graphics Library. Furnish a complete library of standard HVAC equipment such as chillers, air handlers, terminals, fan coils, and unit ventilators. This library shall also include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and duct-work. The library shall be furnished in a file format compatible with the graphics generation package program.
c. Engineering Units. Allow for selection of the desired engineering units (i.e. Inch pound or SI) in the system. Unit selection shall be able to be customized by locality to select the desired units for each measurement. Engineering units on this project shall be: Inch-Pound

D. System Applications. Each work-station shall provide operator interface and off-line storage of system information. Provide the following applications at each work-station.

1. Automatic System Database Save and Restore. Each work-station shall store on the hard disk a copy of the current database of each building controller. This database shall be updated whenever a change is made in any panel in the system. The storage of this data shall be automatic and not require operator intervention. In the event of a database loss in a building management panel, the first work-station to detect the loss shall automatically restore the database for that panel.

2. Manual Database Save and Restore. A system operator with the proper password clearance shall be able to archive the database from any system panel and store on magnetic media. The operator shall also be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.

3. System Configuration. The work-station software shall provide a graphical method of configuring the system. The user with proper security shall be able to add new devices, and assign modems to devices. This shall allow for future system changes or additions.

4. On-Line Help. Provide a context sensitive, on line help system to assist the operator in operation and editing of the system. On line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.

5. Security. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto logoff time shall be set per operator password. All system security data shall be stored in an encrypted format.

6. System Diagnostics. The system shall automatically monitor the operation of all work-stations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator

7. Alarm Processing. Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure the alarm limits, warning limits, states, and reactions for each object in the system.

8. Alarm Reactions. The operator shall be able to determine what actions, if any, are to be taken, by object (or point), during an alarm. Actions shall include logging, printing, starting programs, displaying messages, dialing out to remote stations, paging, providing audible annunciation or displaying specific system graphics. Each of these actions shall be configurable by work-station and time of day. An object in alarm that has not been acknowledged within an operator specified time period shall be re-routed to an alternate operator specified alarm receipt device.

9. Trend Logs. The operator shall be able to define a custom trend log for any data in the system. This definition shall include interval, start-time, and stop-time. Trend intervals of 1, 5, 15, 30, and 60 minutes as well as once a shift (8 hours), once a day, once a week, and once a month shall be selectable. All trends shall start based on the hour. Each trend shall accommodate up to 64 system objects. The system operator with proper password shall be able to determine how many samples are stored in each trend. Trend data shall be sampled and stored on the Building Controller panel and be archived on the hard disk. Trend data shall be able to be viewed and printed from the operator interface software. Trends must be viewable in a text based format of graphically. They shall also

be storable in a tab delimited ASCII format for use by other industry standard word processing and spreadsheet packages. Provide initial programming to trend all HVAC equipment and the building's electrical energy consumption for both the hotel electrical system.

10. Dynamic Graphical Charting. The operator shall be able to select any system point value for charting in real time.

    a. Up to four values at one time shall be selectable for each chart.

    b. The type of chart (bar, line, 3-D, etc.) shall be selectable.

11. Alarm and Event Log. The operator shall be able to view all logged system alarms and events from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and clear alarms. All that have not been cleared by the operator shall be archived to the hard disk on the work-station.

12. Object and Property Status and Control. Provide a method for the operator with proper password protection to view, and edit if applicable, the status of any object and property in the system. These statuses shall be available by menu, on graphics, or through custom programs.

13. Clock Synchronization. The real time clocks in all building control panels and work-stations shall be synchronized on command of an operator. The system shall also be able to automatically synchronize all system clocks, daily from any operator designated device in the system. The system shall automatically adjust for daylight savings and standard time if applicable.

14. Reports and Logs. Provide a reporting package that allows the operator to select, modify, or create reports. Each report shall be definable as to data content, format, interval, and date. Report data shall be archived on the hard disk for historical reporting. Provide the ability for the operator to obtain real time logs of designated lists of objects. Reports and logs shall be stored on the PC hard disk in a format that is readily accessible by other standard software applications including spreadsheets and word processing. Reports and logs shall be readily printed to the system printer. The operator shall be able to designate reports that shall be printed or stored to disk at selectable intervals.

    a. Custom Reports: Provide the capability for the operator to easily define any system data into a daily, weekly, monthly, or annual report. These reports shall be time and date stamped and shall contain a report title and the name of the facility.

E. Work-station Applications Editors. PC work-station shall support full screen editing of all system applications. Provide editors for each application at the PC work-station. The applications shall be downloaded and executed at the appropriate controller panels.

1. Controller. Provide a full screen editor for each type controller and application that shall allow the operator with proper password to view and change the configuration, name, control parameters, and system set-points.

2. Scheduling. An editor for the scheduling application shall be provided at each work-station. Provide a monthly calendar for each schedule. Exception schedules and holidays shall be shown clearly on the calendar. Provide a method for allowing several related objects to follow a schedule. The advance and delay time for each object shall be adjustable from this master schedule.

3. Air System Equipment Coordination. Provide a full screen editor that allows equipment to be grouped for proper operation as specified in the sequence of operations. This shall include the coordination of VAV boxes with their associated Air Handling Equipment, electric duct heaters, terminal units, fans, etc.

4. Custom Application Programming. Provide the tools to create, modify, and debug custom application programming. The operator shall be able to create, edit, and download custom programs at the same time that all other system applications are operating. The system shall be fully operable while custom routines are edited, compiled, and downloaded. The programming language shall have the following features:

2.3 CONTROLLER SOFTWARE

A. System Security

1. User access shall be secured using individual security passwords and user names

2. Passwords shall restrict the user to only the objects, applications, and system functions as assigned by the system manager.

3. User logon/logoff attempts shall be recorded.

E. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each of these schedules shall include the capability for start, stop, optimal start, optimal stop, and night economizer actions. Each schedule may consist of up to [10] events. When a group of objects are scheduled together, provide the capability to define advances and delays for each member. Each schedule shall consist of the following:

1. Weekly Schedule. Provide separate schedules for each day of the week.

2. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. This exception schedule shall override the standard schedule for that day. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed it will be discarded and replaced by the standard schedule for that day of the week.

3. Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.

4. Optimal Start. The scheduling application outlined above shall support an optimal start algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less then and greater than 24 hours. Provide the ability to modify the start algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.

F. Trend Log Application

1. Trend log data shall be sampled and stored on the System Controller panel and shall capable of being archived to a BACnet Workstation for longer term storage.

2. Trend logs shall include interval, start-time, and stop-time.

3. Trend log intervals shall be configurable as frequently as 1 minute and as infrequently as 1 year.

G. Trend Logs

1. The system controller shall create trend logs for defined key performance indicators for each controlled HVAC device and HVAC application.

2. The trend logs shall monitor these parameters for a minimum of 7 days at 15 minute intervals. The automatic trend logs shall be user adjustable

H. Alarm/Event Log

1. Any object in the system shall be configurable to generate an alarm when transitioning in and out of a normal or fault state.

2. Any object in the system shall allow the alarm limits, warning limits, states, and reactions to be configured for each object in the system.

3. An alarm/event shall be capable of triggering any of the following actions:

a. Route the alarm/event to one or more alarm log

b. The alarm message shall include the name of the alarm location, the device that generated the alarm, and the alarm message itself.

c. Route an e-mail message to an operator(s)

d. Log a data point(s) for a period of time

e. Run a custom control program

1. Point Control. User shall have the option to set the update interval, minimum on/off time, event notification, custom programming on change of events.

2. Timed Override. A standard application shall be utilized to enable/disable temperature control when a user selects on/cancel at the zone sensor, building operator interface, or the local operator display. The amount of time that the override takes precedence will be selectable from the building operator interface.

3. Anti-Short Cycling. All binary output points shall be protected from short cycling

2.4 BUILDING CONTROLLERS

A. General. Provide Building Controllers to provide the performance specified in section 1 of this division. Each of these panels shall meet the following requirements.

1. The Building Automation System shall be composed of one or more independent, stand-alone, microprocessor based Building Controllers to manage the global strategies described in System software section.

2. The controller shall provide a communications port for connection of the Portable

Operators Terminal using Point to Point.

3. BACnet physical/data link layer protocol or a connection to the inter-network.

4. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.

5. BACnet. The Building Controller shall use the Read (Initiate) and Write (Execute) Services as defined in Clauses 15.5 and 15.8, respectively, of ASHRAE Standard 135 (latest edition), to communicate with objects in the internetwork. Objects supported shall include: Analog input, analog output, binary input, binary output, device.

B. Communications. Each Building Controller shall reside on an open-protocol inter-network using the ISO 8802-3 (Ethernet) or ARCNET (ASTM 878.1) Physical/Data Link layer protocol. Each Building Controller shall also perform routing to a network of Custom Application and Application Specific Controllers.

C. Memory. The Building Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.

2.5 CUSTOM APPLICATION CONTROLLERS

A. General. Provide Custom Application Controllers to provide the performance specified in section 1 of this division. Each of these panels shall meet the following requirements.

1. The Building Automation System shall be composed of one or more independent, stand-alone, microprocessor based Building Controllers to manage the local strategies described in System software section.

2. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.

B. Controller hardware shall be suitable for the anticipated ambient conditions.

1. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 Type waterproof enclosures, and shall be rated for operation at -40 C to 65 C (- 40 F to 150 F).

2. Controller used in conditioned ambient shall be mounted in NEMA 1 Type rated enclosures, and shall be rated for operation at 0 C to 50 C (32 F to 120 F).

2.6 APPLICATION SPECIFIC CONTROLLERS

A. General. Application specific controllers (ASC) are microprocessor-based DDC controllers which through hardware or firmware design are dedicated to control a specific piece of equipment. They are not fully user programmable, but are customized for operation within the confines of the equipment they are designed to serve.

1. Each ASC shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.

2. Each ASC will contain sufficient I/O capacity to control the target system.

A. Environment. The hardware shall be suitable for the anticipated ambient conditions.

1. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 Type waterproof enclosures, and shall be rated for operation at -40 C to 65 C (- 40 F to 150 F).

2. Controller used in conditioned ambient shall be mounted in NEMA 1 Type rated enclosures, and shall be rated for operation at 0 C to 50 C (32 F to 120 F).

2.7 COMMUNICATIONS

A. This project shall comprise a BACnet inter-network. All PC Workstations and Building Controller components shall meet ASHRAE / ANSI Standard 135 (latest edition), BACnet.

B. Each device shall operate on the open-protocol physical/data link protocols specified for that device as defined earlier in this section.

C. The controls Contractor shall provide all communication media, connectors, repeaters, hubs, and routers necessary for the inter-network.

D. All Building Controllers shall have a communications port for connections with the operator interfaces. This may be either an RS-484 port for Point to Point connection or a network interface node for connection to the Ethernet or ARCNET network.

E. Remote operator interface via high speed internet modem shall allow for communication with any and all controllers on this network as described in the following section.

F. Communications services over the internetwork shall result in operator interface and value passing that is transparent to the internetwork architecture.

2.8 GRAPHICS

A. The system graphical operator interface shall include a digital photo of the completed project on main page with links to each overall floor plan; building section/risers; central cooling plant schematic / waterside flow diagram; plumbing systems; and interfaces to associated controls systems (fire alarm, lighting controls, and security system).

B. Graphical floor plans shall indicate all equipment, risers, motorized dampers, motorized valves, and sensors. System and equipment operating status, device positions, set points, and sensor readings shall be displayed. Provide floor plans for Hotel levels 1, Mezz., 2, 3, 4, 5, 6, 7 & Roof; and Parking Deck levels 1, 2, & 3. Provide full overall floor plans and either dynamic zoom or quick links to part plans.

C. Graphical risers shall include a full building section with links to all air side risers (OA, TE, SP) and waterside risers (CHWS&R, CWS&R). Risers shall include all associated equipment and motorized dampers and valves and shall indicate equipment status, damper and valve positions, space and system temperatures and pressures and set points.

D. Graphical central plant schematic / waterside flow diagram shall include all associated equipment and motorized dampers and valves and shall indicate equipment status, damper and valve positions, space and system temperatures and pressures and set points.

E. Graphical plumbing systems shall include the central pumping and water heating equipment, piping systems and controls; shall include a schematic of the piping systems with all associated equipment and motorized valves; and shall indicate equipment status, damper

and valve positions, space and system temperatures and pressures and set points.

F. Graphical schematic diagrams of equipment shall be provided for all monitored and controlled equipment; linked to plans, risers, and schematics; with all equipment and system input and output data indicated on and dynamically adjustable from the graphical displays.

G. Equipment operating status, device positions, control set points, and sensor status shall be displayed on all graphical drawings. System and equipment status and set points shall be dynamically modifiable direct from graphical drawings.

H. Graphical drawings shall indicate all equipment and device tags and shall reflect the final design drawings with all revisions all dimensional data and miscellaneous notes removed.

I. Control points naming for equipment and systems shall match the design drawings tags and shall provide logical naming for system components without tags (systems, dampers, sensors, set points, etc.) that include associated equipment tags where applicable. Generic manufacturer’s default names only are not acceptable. Provide a link to a legend for control point naming convention.

2.9 AUXILIARY CONTROL DEVICES

A. GENERAL

1. The automatic temperature control products shall be provided in sizes and capacities required to perform the sequence of operations specified herein, consisting of panels, thermostats, sensors, firestats, controllers (electric and electronic) having keypad access and hand held terminal interface capabilities, and other components as required for a complete installation. Except as otherwise indicated, provide manufacturer's standard control system components as indicated by published product information, designed and constructed as recommended by manufacturer. Provide the electric/electronic direct digital control system with the functional and construction features as herein specified.

2. Should any equipment that is enabled and programmed to operate, malfunction (as identified by an air or water flow switch sensing a "no flow" condition and flow), and flow is not reestablished within one minute, adjustable, the system shall initiate the audible alarm.

B. Motorized dampers, unless otherwise specified elsewhere, shall be as follows:

1. Damper frames shall be 16 gauge galvanized sheet metal or 1/8" extruded aluminum with reinforced corner bracing.

2. Individual damper sections shall not be larger than 48" x 60". Provide a minimum of one damper actuator per section.

C. Control Valves

1. Control valves shall be two-way or three-way type for two-position or modulating service as scheduled or shown.

2. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:

3. Sizing Criteria:

a. Two-position service: Line size.

b. Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or [5] psi, whichever is greater.

c. Three-way Modulating Service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), [5] psi maximum.

d. Valves 1/2" through 2" shall be bronze body or cast brass ANSI Class 250, spring loaded, Teflon packing, quick opening for two-position service. Two-way valves to have replaceable composition disc, or stainless steel ball.

e. 2-1/2" valves and larger shall be cast iron ANSI Class 125 with guided plug and Teflon packing.

4. Water valves shall fail normally open or closed as scheduled on plans or as follows:

5. Condenser water control valves - normally closed.

6. Other applications - as scheduled or as required by sequence of operation.

7. Zone valves shall be sized to meet the control application and they shall maintain their last position in the event of a power failure.

D. Wired Temperature Sensors

1. Temperature sensors shall be RTD or thermistor.

2. 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 m2 (10 ft2) of duct cross section.

3. Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed. The well must withstand the flow velocities in the pipe.

4. Space sensors shall be equipped with setpoint adjustment, override switch, display, and/or communication port as shown on plans.

5. Provide matched temperature sensors for differential temperature measurement.

E. Wired Humidity Sensors

1. Duct and room sensors shall have a sensing range of 20% to 80%.

2. Duct sensors shall be provided with a sampling chamber.

3. Outdoor air humidity sensors shall have a sensing range of 20% to 95% rh. They shall be suitable for ambient conditions of 40°C to 75°C (40°F to 170°F).

4. Humidity sensor’s drift shall not exceed 1% of full scale per year.

F. Static Pressure Sensors

1. Sensor shall have linear output signal. Zero and span shall be field-adjustable.

2. Sensor sensing elements shall withstand continuous operating conditions plus or minus 50% greater than calibrated span without damage.

3. Water pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Sensor shall be complete with 4-20 ma output, required mounting brackets, and block and bleed valves. Mount in location accessible for service.

4. Water differential pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (DP) and maximum static pressure shall be 3,000 psi. Transmitter shall be complete with 4-20 ma output, required mounting brackets, and five-valve manifold. Mount in a location accessible for service.

G. Low Limit Thermostats

5. Safety low limit thermostats shall be vapor pressure type with an element 6m [20 ft] minimum length. Element shall respond to the lowest temperature sensed by any one foot section.

6. Low limit shall be manual reset only.

H. Carbon Dioxide Sensors

1. Carbon Dioxide sensors shall measure CO2 in PPM in a range of 0-2000 ppm. Accuracy shall be +/- 3% of reading with stability within 5% over 5 years. Sensors shall be duct or space mounted as indicated in the sequence of operation.

I. Flow Switches

1. Flow-proving switches shall be either paddle or differential pressure type, as shown.

2. Paddle type switches (water service only) shall be UL listed, SPDT snap-acting with pilot duty rating (125VA minimum) and shall have adjustable sensitivity with NEMA 1 enclosure unless otherwise specified.

3. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application or as specified.

J. Relays

1. Control relays shall be UL listed plug-in type with dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage shall be suitable for application.

2. Time delay relays shall be UL listed solidstate plug-in type with adjustable time delay. Delay shall be adjustable ±200% (minimum) from setpoint shown on plans. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

K. Current Switches

1. Current-operated switches shall be self-powered, solid state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

L. Differential Pressure Type Switches (Air or Water Service)

1. Shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application or as shown.

M. TRANSFORMERS and POWER SUPPLIES

1. Control transformers shall be UL listed, Class 2 current-limiting type, or shall be furnished with over-current protection in both primary and secondary circuits for Class 2 service.
2. Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 3.0 mV maximum Peak-to-Peak. Regulation shall be 0.10% line and load combined, with 50 microsecond response time for 50% load changes. Unit shall have built-in over-voltage protection.

3. Unit shall operate between 0 C and 50 C.

4. Unit shall be UL recognized.

N. LOCAL CONTROL PANELS

1. All indoor control cabinets shall be fully enclosed NEMA 1 Type construction with [hinged door], key-lock latch, and removable sub-panels. A single key shall be common to all field panels and sub-panels.

2. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.

3. Provide on/off power switch with over-current protection and main air gauge for control power sources to each local panel.

O. FIRESTATS, SMOKE DETECTORS, AND FREEZESTATS

1. Firestats shall be provided for air units circulating less than 2000 CFM air volume. Firestats shall be manual reset, adjustable type set at 125°F. Control contractor shall hard wire interlock the firestat to shut down fan on rise above setpoint and signal the fire alarm system.

2. Control contractor shall hard wire interlock the duct mounted smoke detector to shutdown fan on smoke detection and send a signal to the fire alarm system.

3. Duct mounted smoke detectors shall be provided by Electrical Contractor and installed by the mechanical contractor. All necessary interlocks, relays, etc., with smoke detection system and mechanical equipment, shall be provided by the controls Contractor.

4. Freezestats (averaging bulb type) with manual reset shall be hard wired and provided for each water coil in air systems utilizing unheated outside air. Mount freezestats upstream

of coil. Set freezestats to shut down fan at 40°F (Adjustable). Freezestat shall shut down fan when low temperature is sensed across any 1 foot section.

P. ELECTRONIC SENSORS

1. Provide electronic temperature of supersensitive (+/-0.5F) resistance type, which are vibration and corrosion-resistant, and of wall mounted immersion, duct mounting, averaging or built-type as required for applications.

2.10 WIRING AND RACEWAYS

A. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of this specification.

B. All insulated wire to be copper conductors, UL labeled for 90°C (194°F) minimum service.

2.11 WIRING

A. All control and interlock wiring shall comply with the National, Local Electrical Codes, and Section 26000 of these Contract Document specifications. Where the requirements of this section differ with those in Section 26000, the requirements of this section shall take precedence.

B. Where Class 2 wires are in concealed and accessible locations; including ceiling return air plenums, approved cables outside of electrical raceway can be used provided that the following conditions are met:

1. Circuits meet NEC Class 2 (current limited) requirements. (Low voltage power circuits shall be sub fused when required to meet Class 2 current limit.)

C. Do not install Class 2 wiring in conduits containing Class 1 wiring.

D. Where Class 2 wiring is run exposed, wiring shall be run parallel along a surface or perpendicular to it, and bundled, using approved wire ties at no greater than 3 m [10 ft] intervals. Such bundled cable shall be fastened to the structure, using industry approved fasteners, at 1.5 m [5 ft] intervals or more often to achieve a neat and workmanlike result.

E. All wire-to-device connections shall be made at a terminal blocks or terminal strip.

F. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations in accordance with Contract Documents and National and/or Local Codes.

G. Adhere to Section 26000 requirements for installation of electrical raceways.

H. BAS manufacturer shall terminate all control and/or interlock wiring and shall maintain updated (as built) wiring diagrams with terminations identified at the job site.Flexible metal conduits and liquid tight flexible metal conduits shall not exceed 3' in length and shall be supported at each end. Flexible metal conduit less than 1/2" electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid tight, flexible metal conduits shall be used.

2.12 CONTROLLERS

A. Provide a separate DDC Controller for individual HVAC mechanical equipment. DDC

Controllers shall be factory mounted, installed, and wired by mechanical equipment manufacturer as specified. Controllers shall match and be compatible with building automation system and connected equipment.

Building Controllers and Custom Application Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type (analog or digital) found at each loca¬tion. If input points are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point used in each controller.

PART 3 – EXECUTION

3.01 GENERAL WORKMANSHIP

A. Install equipment, piping, wiring/conduit parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

C. Install all equipment in readily accessible location as defined by chapter 1 article 100 part A of the NEC. Control panels shall be attached to structural walls unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.

D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.02 INSTALLATION

A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings, and the Contract Documents. The controls shall be installed to provide a completely functional and fully coordinated system of control. The controls shall include all components required to meet the specified sequences of operation.

B. Fasten flexible connections, bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support tubing neatly.

C. Number-code or color-code tubing, except local and individual room control wiring, for future identification and servicing of control system.

D. Controls, access doors, specialties, and accessories shall be installed so as to allow ready accessibility for operating, servicing, maintaining, and repairing.

E. The Contract Documents have been prepared with consideration given to avoid interferences with other trades and building appurtenances; however, interferences may exist. It is the responsibility of the controls Contractor to coordinate the activities to eliminate all interferences.

F. Contract Documents shall be considered schematic only, and are not intended to indicate all changes in direction and necessary fittings to be provided by the Contractor. Conduit, piping,

and/or ductwork may be relocated or offset for proper clearances. Deviations from Contract Documents shall have the Engineer's approval prior to submitting bids. Cost of these deviations to avoid interferences shall be a part of the original contract.

G. The design intent, i.e., pitches, velocities, pressure drops, voltage drops, cable pulling tensions, etc., shall not be greatly altered without the approval of the Engineer.

H. Record drawings shall reflect ALL deviations.

3.03 CALIBRATION OF INSTRUMENTATION AND CONTROLS

A. All controls and instrumentation shall be calibrated a minimum of two times and included in the contract. One shall occur during the summer months and the other during the winter months at such time when ability of equipment to perform at design capacity can be demonstrated.

3.04 ELECTRICAL INSTALLATION REQUIREMENTS

A. General: Electrical work performed in the installation of the automatic temperature controls as described shall be in accordance with electrical Specifications and the National Electrical Code (NEC) and applicable state and local codes. All wiring shall be installed in conduit. Where exposed, conduit shall be run parallel to building lines properly supported and sized at a maximum of 40% fill. In no cases shall field installed conduit smaller than 1/2" trade size be allowed. Mount controllers at convenient locations and heights.

3.05 ADJUSTING AND CLEANING

A. Start-Up: Start-up, test, and adjust the automatic temperature controls. Demonstrate compliance with requirements to the Owner. Replace damaged or malfunctioning controls and equipment. The controls Contractor along with the Contractor and his representatives shall be available to provide building commissioning.

B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

C. Final Adjustment: After completion of the installation, perform final calibrations and adjustments of the equipment provided under this Contract and supply services incidental to the proper performance of the automatic temperature controls under warranty.

3.06 CLOSEOUT PROCEDURES

A. Owner's Instruction: Provide three copies of an operator's manual describing all operating and routine maintenance service procedures to be used with the temperature control supplied. Provide control shop drawings, submittal material, Operating and Maintenance (O & M) manuals, "as-built" drawings, etc. along with the address, telephone number, and name of the control system manufacturer's local branch office service manager to the Owner. Instruct the Owner these procedures during the startup and test period. The duration of the instruction period shall be no less than 40 hours, during normal working hours.

B. Turn over to the Owner two sets of any special tools and keys needed for the operation, adjustment, or resetting of the control equipment. These tools and keys shall be individually tagged indicating their function and each set packaged in a labeled box.

C. The Contractor shall provide all other necessary shop drawings, submittal data, O & M manuals, and "as-built" drawings to the Owner.

D. Acceptance: Upon completion of the calibration, startup the system and perform all necessary testing and run diagnostic tests to ensure proper operation. The controls Contractor shall be responsible for performing the sequence of control specified as witnessed by the Commissioning Authority. Schedule training instructions and the acceptance test with at least seven (7) days notice to the Owner Representative.

E. Warranty: Control devices and installation shall be warranted to be free from defects in workmanship and material for a period of one year from the date of job acceptance by the Owner. In addition, all parts shall be warranted for one (1) year. Any equipment or labor found to be defective during this period shall be repaired or replaced without expense to the Owner. Factory authorized warranty service shall be available within 50 miles of jobsite.

END OF SECTION 230933

SECTION 231123 – NATURAL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 21 Specifications, and Division 01 Specification Sections, apply to this Section.

B. Section 23 05 00 "Mechanical General" applies to work of this section.

C. Refer to the following sections for related work in connection with the natural gas piping system:
23 05 01 Schedule of Submittal Data
23 05 29 Pipe Hangers and Supports

1.2 DESCRIPTION OF WORK:

A. Provide natural gas piping to gas fired equipment.

B. The new gas distribution piping for this project is at 2 psi. Provide regulators, valves, and low pressure run-out to equipment connection.

C. Extent of natural gas systems work is indicated on the drawings and by requirements of this section.

1.3 QUALITY ASSURANCE:

A. Manufacturing firms shall be regularly engaged in the manufacture of natural gas system products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installation contracting firms shall have at least three (3) years of successful installation experience on projects with natural gas systems work similar to that required for the project.

1.4 CODES AND STANDARDS:

A. Fabricate and install natural gas systems in accordance with the following codes and standards: NFPA No. 54, "Fuel Gas Code".

B. Install natural gas systems in accordance with local gas utility company requirements and local building department requirements.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with NFPA 54 where applicable; base pressure rating on natural gas piping system maximum design pressures. Provide sizing and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in natural gas systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.2 BASIC PIPE AND PIPE FITTINGS:

A. Type: Black steel pipe.

B. Class: Schedule 40, ASTM A-53.

C. Fittings: Class 150 malleable iron threaded or MegaPress G. Piping larger than 2” shall be welded.

D. Joints: Threaded.

2.3 PROTECTIVE COATINGS

A. Paint all gas piping on the roof with anti-corrosive paint suitable for exposure to the elements.

2.4 BASIC IDENTIFICATION:

A. Provide identification for building distribution piping with plastic pipe markers.

B. Provide identification for gas valves with brass valve tags.

C. Provide identification of underground piping with plastic warning tape.

2.5 BASIC PIPING SPECIALTIES:

A. Provide all necessary piping specialties including Pipe escutcheons, Dielectric unions, Pipe sleeves, and Sleeve seals.

2.6 PIPE HANGERS, SUPPORTS AND ANCHORS:

A. Provide supports and anchors complying with Section 23 05 29 "Pipe Hangers & Supports".

2.7 GAS COCKS:

A. Gas Cocks - 150 psi non-shock WOG, bronze straightway cock, flat or square head, threaded ends. Ball valves may be utilized for gas cocks.

B. Subject to compliance with requirements, provide gas cocks of one of the following: Powell (The Wm.) Co., Stockham Valves and Fittings, Walworth Co.

2.8 GAS PRESSURE REGULATORS:

A. Gas pressure regulators shall be selected, by the contractor, so that no gas pressure greater than equipment maximum inlet pressure is introduced to equipment. Regulators may be self-limiting type.

B. Gas regulators shall be installed as indicated. Regulator vent shall be routed to the outdoors or regulator shall be provided with a vent limiting means.

C. Acceptable manufacturers for gas pressure regulators are Equimeter, Maxitrol, or American Meter.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which natural gas systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF NATURAL GAS PIPING:

A. Use sealants on metal gas piping threads which are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.

B. Remove cutting and threading burrs before assembling piping.

C. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped or damaged.

D. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connections are completed.

E. Install drip legs in gas piping where indicated and at base of risers, at connections to equipment and where required by code or regulation. Pitch piping where possible to drain to drip legs.

F. Changes in direction shall be made with fittings. Changes in pipe size shall be made with reducing fittings. Bushings will not be permitted.

G. Use dielectric unions where dissimilar metals are joined together.

3.3 INSTALLATION OF VALVES:

A. Provide gas cocks at connection to gas train for each gas fired equipment item and on risers and branches where indicated

3.4 EQUIPMENT CONNECTIONS:

A. Connect gas piping to each piece of gas fired equipment with (in order) union, shut-off valve, drip leg with threaded cap, pressure regulator, and flexible connection (flexible connection only required if connected equipment has a motor). Comply with equipment manufacturer's instructions and verify equipment operating pressure range.

B. Pressure regulating valves are to be provided on all equipment.

C. If pressure regulators are not provided as part of the equipment gas train it is to be provided as part of this section.

3.5 TESTING:

A. Inspect, test, and purge natural gas systems in accordance with NFPA 54, the local utility requirements and the local code officials.

B. All gas piping shall be tested with air at a minimum of 50 psi for two (2) hours without any drop in pressure.

C. Repair or replace piping as required to eliminate leaks and retest to the satisfaction of the Engineer.

D. Entire installation of underground piping shall be tested using holiday detector and testing procedures as described in American Water Works Association (AWWA) C209-76.

E. All pressure tests shall be conducted in presence of Owner's representative and shall be certified or otherwise documented to the satisfaction of the Engineer.

3.6 ADJUSTING AND CLEANING:

A. Clean and inspect natural gas system components, including regulators, relief valves, etc.

B. Thoroughly air blow all piping and drain and clean all dirt and drain legs.

3.7 SPARE PARTS:

A. Furnish to Owner, with receipt, two (2) valve wrenches for each type of gas valve installed, requiring same.

3.8 PAINTING:

A. All piping on exterior of building shall be primed and painted to match exterior of building.

END OF SECTION 231123

SECTION 232100 - HVAC PIPING

PART 1 – GENERAL

1.1 SCOPE

A. This section of the specifications and related drawings describe the requirements pertaining to the piping systems for heating and cooling including but not limited to the following:

1. Refrigerant Piping.
2. Condensate drain piping from air units and equipment.
3. Refrigerant relief vent piping.
4. Chilled water piping.

B. All work specified in this Section is subject to the provisions of Section 23 05 00. See other sections of the project specifications that may apply to components or accessories related to this installation.

C. Extent of the piping systems work is indicated on the Drawings and schedules and by the requirements of this section.

D. The construction requirements herein shall include appurtenant structures and buildings to which the piping system is to be installed.

1.2 QUALITY ASSURANCE

A. All piping work shall comply with requirements in this section of specifications.

B. All piping furnished and installed under this section of these specifications shall be new and in first class condition.

C. All piping furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor’s expense.

D. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

E. Materials shall be provided by firms regularly engaged in the manufacture of piping products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

F. All welders employed for the performance of this work shall be fully qualified and so certified by ANSI B31.1.0-1967 “Standard Qualification Welding Procedures, Welders and Welding Operators” or “Qualification Tests” in Section IX, ASME Boiler and Pressure Vessel Code. Welder performance qualification tests for positions 2G and 5G shall be made in strict compliance with the above codes. Welders shall be certified for the type of pipe material specified herein. All costs incident to procedures and welder’s qualification tests shall be assumed by the Contractor. Two (2) copies of the qualification test report and certification with welder’s identification number and letter shall be delivered to the Engineer, via the Architect, for his file before any welding

commences. Each weld shall bear the welder's identification mark permanently indented in the weld. No welding shall be done when the ambient temperature is below 0˚ F.

G. Certify brazing procedures, brazes and operators in accordance with Section IX ASME Boiler and Pressure Vessel Code (ANSI B31.5). Two (2) copies of the qualification test report and certification shall be submitted to the Architect.

1.3 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in new first class condition. Rusted, soiled and/or contaminated pipe shall not be permitted for use. Pipes shall bear markings indicating ASTM specification, grade and other pertinent identification markings, including where manufactured. Unmarked pipe shall not be permitted for use.

B. Store pipe in racks or other suitable means so as to protect from weather, construction work traffic and contamination. Where pipe is stored outdoors, Contractor shall cover in a suitable manner to prevent water, dirt, mud and/or debris from entering pipe. Pipe shall not be laid on grade for storage.

C. Pipe found to be contaminated with water, dirt, mud and/or other debris shall be cleaned and restored to new condition to the satisfaction of the Architect. Contaminated pipe shall not be used until inspected.

D. Rusted pipe shall not be used and shall be removed from the job site at the Contractor's expense.

1.4 SUBMITTALS AND COORDINATION

A. Provide submittal data in accordance with specifications Sections 23 05 00 and 23 05 01.

B. Submit product data, including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties and accessories, and installation instructions for each specialty and special duty valve specified.

C. Provide certification of compliance with ASTM and ANSI manufacturing requirements, where applicable.

D. Furnish flow and pressure drop curves for diverting fittings, circuit setters, and balancing valves, based on manufacturer testing.

E. Provide maintenance data for specialty components and special duty valves, for inclusion in operating and maintenance manual.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate the installation of pipe sleeves for floor penetrations and wall penetrations.

PART 2 – PRODUCTS

2.1 PIPING MATERIALS

A. Steel piping materials shall be as follows:

1. Type 1 - Black steel pipe conforming to ASTM A53 CW Schedule 40, with threaded and coupled ends.
2. Type 2 - Black steel pipe conforming to ASTM A53 Grade B, Seamless, Schedule 40, with plain ends.
3. Type 3 - Black steel pipe conforming to ASTM A53 Grade B, Standard Weight, Schedule 40, with plain ends.

B. Copper piping materials shall be as follows:

1. Type 100 - Type L hard drawn copper tubing conforming to ASTM B88.
2. Type 101 - Type M hard drawn copper tubing conforming to ASTM B88.
3. Type 102 - Type ACR hard drawn copper tubing conforming to ASTM B88.
4. Type 103 – Type ACR annealed (soft) copper tubing rated for refrigerant service conforming to ASTM B280.

C. CPVC piping materials shall be as follows:

1. Type 200 - Schedule 40 CPVC piping with solvent welded joints, “25/50 flame/smoke” rated for plenum applications, 150 psi working pressure rating.

2.2 PIPE FITTINGS

A. Steel pipe fitting materials shall be as follows:

1. Type 1A - Class 300 standard black malleable iron pipe fittings conforming to ANSI B 16.3 for dimensions, ASTM - A 197 for material, and ANSI B 1.20.1 for pipe threads. Unions shall be of ground joint brass seat type and conform to ANSI B 16.39 for dimensions and pressure ratings.
2. Type 1B - Standard weight butt-weld carbon steel pipe fittings conforming to ANSI B 16.9 for dimensions and ASTM - A 234 for material.
3. Type 1C - Extra strong butt-weld carbon steel pipe fittings conforming to ANSI B 16.9 for dimensions and ASTM - A 234 for material.
4. Type 1D - 300 lb. carbon steel flanges conforming to ANSI B 16.5 for dimensions and ASTM - A 181 for material.

B. Copper pipe fitting materials shall be as follows:

1. Type 2A - Wrought copper solder joint fittings conforming to ANSI B16.22.
2. Type 2B - Cast copper alloy solder joint fittings conforming to ANSI B16.18.
3. Type 2C - Cast copper alloy flared tube fittings conforming to ANSI B16.26.
4. Type 2D - Class 150 cast copper alloy flanges conforming to ANSI B16.24.

2.3 SERVICES

A. Condensate drain piping from HVAC equipment within mechanical rooms and condensate drain piping subject to pedestrian traffic:

1. Type 200 pipe.
2. Matching fittings with solvent weld joints.

B. Relief piping, blow-offs, refrigerant vent piping, and miscellaneous piping not otherwise specified:

1. Type 1 pipe (1/4" to 2").
2. Nipples shall be fabricated from Type 1 pipe.

3. Type 2 pipe (2-1/2" to 8").
4. Type 1A pipe fittings (1/4" to 2").
5. Type 1B pipe fittings (2-1/2" & up).
6. Type 1D flanges (2-1/2" & up).

C. Condensate drain piping, other than listed above:
1. Type 101 pipe.
2. Type 2A copper fittings.

D. Refrigerant piping:
1. Type 102 pipe.
2. Type 2A (ACR wrought copper) fittings.

E. Chilled water piping:
1. Type 3 pipe.

2.4 PIPE THREAD SEALANTS

A. Teflon tape made from PTFE may be used as a pipe sealant for all threaded pipe joints except those where pipe is threaded into cast iron valve connections, cast iron fittings, or cast iron equipment connections.

B. Pipe sealants having soft-set characteristics shall be used at all threaded connections. Contractor may utilize soft-set sealants at all threaded connections.

C. Do not use any sealants containing Teflon for threaded pipe joints where pipe is threaded into cast iron valve connections, cast iron fittings, or cast iron equipment connections.

2.5 SLEEVES

A. Cut sleeves from standard weight black steel pipe for fire rated penetration or 18 gauge galvanized steel for penetration through non-rated construction.

B. Size all sleeves to include pipe expansion and size insulated pipe sleeves to easily include the insulation.

C. Where pipes pass through slabs, sleeves shall be standard weight black steel pipe with top of sleeve one (1") inch above finished floor. Where pipes pass through fire rated or masonry walls, sleeves shall be standard weight black steel pipe with ends flush with wall surfaces. Where pipes pass through non-rated walls, sleeves shall be 18-gauge galvanized sheet metal with ends flush with wall surfaces. Sleeves through exterior walls shall be steel pipe, flush with the exterior surfaces, and with the space between the pipe and the sleeves caulked watertight in an approved manner.

D. Each pipe or duct passing through non-rated walls, ceilings or partitions shall be provided with sleeves having internal diameters one-half inch (1/2") larger than the outside dimensions of insulated pipes or ducts. Each pipe or duct passing through fire rated walls or floors requiring fire caulking shall be installed with clearances required as per fire caulk manufacturer’s published installation instructions.

E. All pipe sleeves through existing floors, roofs and masonry walls shall be built in place as the affected walls, floors and roof are constructed.

F. All penetrations through rated floors and walls shall be sealed with a U.L. listed assembly by Hilti, 3M, Nelson or Dow. Materials shall meet or exceed UL 1479 or ASTM E814 requirements.

2.6 LOW VOC EMISSIONS MATERIALS USE ONLY

A. Only products that are rated for low emissions of volatile organic compounds (VOC's) shall be used for all equipment, products and materials installed on the project, including related construction materials components such as paints, solvents, sealants, glues and adhesives, insulation, etc.

PART 3 – EXECUTION

3.1 GENERAL

A. Contractor shall not fabricate and/or install piping until Architect/Engineer has reviewed shop drawings for compliance with engineer design concept.

B. Any piping fabricated and/or installed prior to the Architect/Engineer's review found to be in non-compliance shall be removed or corrected as per instructions from Architect/Engineer at Contractor's expense.

C. Install and test the piping and equipment as specified in Sections 23 05 00 and 23 05 93, and in accordance with the specified codes and standards.

D. Adequate fire protection safeguards shall be employed in connection with welding operations.

E. Open ends of pipe lines shall be plugged during installation to keep dirt and foreign material out of the system.

F. Spool Pieces: Provide full line size spool pieces in the main condenser water supply piping in the main central plant piping systems for piping inspections. The spool piece shall have flanges upstream and downstream of a full size valve that can be closed and the spool piece removed for inspection. Provide a full size bypass section around the spool piece with valve to allow flow to bypass the spool piece to maintain system operation.

G. Annealed copper piping shall be installed continuously between pieces of equipment served; no splicing is allowed.

3.2 EXAMINATION

A. Contractor to examine areas and conditions under which piping is to be installed and notify Architect in writing of those conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.3 INSTALLATION OF SLEEVES

A. Pipes passing through concrete and masonry walls and partitions and through concrete floor shall be provided with pipe sleeves which shall be installed during construction of walls, partitions and floors. All pipe sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors and roof are constructed.

1. Sleeves are not required for water and waste connections through a wall or partition to an individual fixture.
2. Sleeves are not required for cast-iron pipe through concrete slab on grade
3. Sleeves shall not be installed in structural members of work, except as detailed on structural drawings, or as reviewed by Structural Engineer.

B. Install sleeves accurately centered on pipe runs so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion. Where insulation includes vapor barrier jacket, provide sleeve with sufficient clearance for installation.

C. Sleeve materials, sizes, lengths and sealing shall be as described in specification Section 23 05 00.

D. Where exposed piping, bare and insulated, passes through floors, walls and ceiling, except in Mechanical Rooms, escutcheons shall be provided. Escutcheons shall be chrome-plated steel plates, hinged type with set screw. Escutcheons shall be as manufactured by Bea-Cor, F&S or Grinnell. Escutcheons for chrome plated connections at plumbing fixtures shall be as specified under the plumbing fixtures.

E. All pipe penetrations shall be sealed in accordance with the details shown on Drawings and/or noted in these Specifications.

F. Insulated piping passing through fire-rated walls or floors must have the pipe insulation interrupted on both sides of the fire-rated wall/floor penetrations as shown on Drawings

3.4 JOINTS

A. All screwed joints in steel piping, except as hereinafter specified, shall be made with regular standard couplings. Apply pipe joint compound to the male threads only. All threads shall be standard, clean cut and tapered and not more than two (2) threads shall be exposed when joint is made tight. All burrs shall be reamed from inside of the pipe, and pipe shall be turned on end and all loose dirt and scale knocked out.

B. Pipes with threads stripped, chipped or damaged or split pipe or defective fittings shall not be used. Caulking of threaded joints to stop or prevent leaks shall not be permitted.

C. Welded joints shall be fusion-welded using welding rods of substantially the same material as the pipe. Changes in direction of piping shall be made with welding fittings only. Mitering or notching pipe to form elbows and tees will not be permitted. Branch take-offs at 90 degrees from mains shall be made with welding tee fittings, except as specified hereinbefore.

1. Defective Welding: Defective welds shall be removed and replaced at no additional cost to the Owner. Repairing of defective welds by adding new material over the defects or by peening shall not be permitted.

D. Joints and connections in copper piping shall be sweat type and shall not be installed in partitions or walls or where inaccessible for testing, inspection, and rework. Install lines under floor slab or underground in under-floor conduit designed to allow for removal of lines. Make provisions to prevent contact of dissimilar metals. During construction, cap all tubing to prevent debris from entering; keep in dry location.

E. Copper tubing shall be cut square and burrs shall be removed. Outside of tubing shall be cleaned with sand cloth and inside of fittings shall be cleaned with fitting brush before joining.

1. Joints in copper tubing for water service shall be made with a non-corrosive paste flux and solid string solder composed of 95% tin and 5% antimony. 50- 50 solder shall not be permitted.
2. Joints in copper tubing for refrigerant piping shall be silver brazed with silver solder having a melting point in excess of 1000 degrees F.

F. For flared joints, the ends of tubing shall be uniform and free from cracks or flaws and shall be fully flared with proper flaring tool at an approximate angle of 45 degrees.

G. Annealed copper piping shall be installed continuously between pieces of equipment served; no splicing is allowed.

3.5 PITCH OF PIPING

A. Horizontal runs of circulating piping shall be graded upward in the direction of water flow or run dead level, as indicated by a spirit level. Reducers shall be eccentric type installed so as to cause no unvented high points in piping and/or no entrapment of condensate.

B. Unless indicated otherwise on the drawings, horizontal condensate lines shall pitch down in the direction of flow with a grade of not less than 1/8” per foot.

3.6 EQUIPMENT CONNECTIONS

A. Provide pipe, fittings, valves and flanges or unions, and make piping connections to apparatus and equipment. Provide shut-off valves at each piece of equipment to isolate the equipment from the associated piping systems.

B. Provide all interconnecting piping for equipment.

C. Piping connections shall be connected independently of and shall place no strain on the equipment connection.

3.7 EQUIPMENT DRAIN, PIPING RISER DRAINS, AND PUMP DRIP DISCHARGE PIPING

A. Provide all drain, drip and discharge piping for apparatus, equipment, and at the bottom of all guest room condenser water risers specified in this Division.

B. Arrangement of equipment and pump drip piping: Route and turned down into nearest drain with proper air gap. Run horizontal piping parallel to walls; run vertical piping plumb.

C. Run equipment and pump drip drain pipe to permit cleaning of floor. Where possible, bracket piping to equipment foundations or to walls at least 2" above the floor with Grinnell Fig. 139 and anchor flange to floor.

D. Terminate equipment and pump drip drain pipe at floor drains with an elbow over drain grate. Horizontal drain pipes may be combined into one pipe that is one pipe size larger than the largest connecting pipe.

E. Trap each air conditioning system condensate drip pan with fabricated galvanized cast iron screwed P-trap. Run drain line full size from outlet connection to point of indirect waste discharge into plumbing drains.

3.8 RELIEF VALVE DISCHARGE PIPING

A. Provide all discharge piping for relief valves specified in this Section.

B. Discharge from relief valve discharge to nearest floor drain.

C. Arrangement of Piping: Route and turned down into nearest drain with proper air gap. Run horizontal piping parallel to walls; run vertical piping plumb.

D. Run pipe to permit cleaning of floor. Where possible, bracket piping to equipment foundations or to walls at least 2" above the floor with Grinnell Fig. 139 and anchor flange to floor.

E. Terminate drain-pipe at floor drains with an elbow over drain grate. Horizontal drain-pipes may be combined into one pipe that is one pipe size larger than the largest connecting pipe.

F. Termination of all relief valve discharge piping shall be cut at 45-degree angle to preclude to installation of any fittings which would restrict relief discharge.

3.9 FLUSHING AND CLEANING AND WATER TREATMENT

A. Care shall be exercised to prevent dirt and foreign matter from entering piping during construction. Flush all piping after installation to remove dirt and foreign matter by draining from the low points.

3.10 OPERATIONAL TESTS

A. When installation and adjustment is complete, perform Operational Tests of all system components at normal operating pressures as specified herein and include the following tests:

1. Operate all manual and automatic valves at least three (3) full open-close cycles; examine for and correct any leakage, failure to open/close, or other malfunction. Replace equipment which cannot be satisfactorily corrected.
2. Refrigerant piping shall be charged with nitrogen and leak tested at 150% of maximum system operating pressure for at least 8 hours without loss of pressure. After purging nitrogen and filling piping system with refrigerant, operate system for at least 4 hours and check for refrigerant leaks with a refrigerant detection device.

END OF SECTION 232100

SECTION 233113 – DUCTS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. This section of the specifications and related drawings describe the requirements pertaining to the ductwork for heating, cooling and ventilating including but not limited to the following:

1. Rectangular metal ductwork.
2. Round metal ductwork.
3. Low-pressure ductwork.
4. Medium-pressure ductwork.
5. Grease hood exhaust ductwork.
6. Plenums.
7. Flexible Ductwork.

B. Extent of the ductwork is indicated on the Drawings and by the requirements of this section.

C. The construction requirements herein shall include appurtenant structures and buildings to which the ductwork is to be installed.

1.2 QUALITY ASSURANCE

A. All ductwork shall comply with requirements as specified in this section of these specifications.

B. All ductwork furnished and installed under this section of these specifications shall be new and in first class condition.

C. All ductwork furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor’s expense.

D. Codes and Standards:

1. SMACNA: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
2. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 16 "Duct Construction," for fabrication and installation of metal ductwork.
3. Underwriters Laboratories: Construct air duct in accordance with UL Standard 181.
4. NFPA: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
5. ASTM E84, NFPA 90A and 90B, and UL723.
6. Maximum Flame spread index = 25; Maximum Smoke Developed Index = 50.

E. The Codes and regulations (i.e. SMACNA Duct Construction and Installation Standards) referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

F. Installer's Qualifications: Company with at least five (5) years of successful installation experience on projects with metal ductwork systems similar to that required for project.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for ductwork materials and products.

B. Ductwork fabrication shop drawings (shop standards) shall be submitted as part of the shop drawing submittal.

C. Shop Drawings: Submit 1/4” = 1’-0” scale layout drawings of ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Duct locations, sizes and proportions shown shall be followed as nearly as practicable. However, locations and width by height ratio of ducts may be changed a reasonable amount to fit the job conditions at no additional cost to the Owner. Show interface and spatial relationship between ductwork and proximate equipment. Note on the shop Drawings any unresolved point of interference. Show modifications of indicated requirements, made to conform to local shop practice, and how these modifications ensure that free area, materials, and rigidity are not reduced.

D. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Sections 23 05 00 and 23 05 01.

E. Maintenance Data: Submit maintenance data and parts lists for ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Section 23 05 01.

1.4 DELIVERY, STORAGE AND HANDLING

A. Protection: Prevent end damage and protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, handling.

B. Deliver materials to job site in new first class condition. Rusted, soiled and/or contaminated ductwork shall not be permitted for use.

C. Store ductwork utilizing suitable means so as to protect from weather, construction work traffic and contamination. Where ductwork is stored outdoors, Contractor shall cover in a suitable manner to prevent water, dirt, mud and/or debris from entering. Ductwork shall not be laid on grade for storage.

D. Ductwork found to be contaminated with water, dirt, mud and/or other debris shall be cleaned and restored to new condition to the satisfaction of the Architect. Contaminated ductwork shall not be used until inspected.

E. Rusted ductwork shall not be used and shall be removed from the job site at the Contractor’s expense.

1.5 DEFINITIONS

A. SMACNA Standards indicated shall be defined as standards published by the Sheet Metal Contractor’s National Association, Inc.

B. Seams: The joining of two (2) longitudinally (same direction as airflow through ductwork) oriented edges of sheet metal ductwork material occurring between two (2) transverse joints.

C. Joints: Transverse (girth of ductwork) joints, branch intersections, tap collars, louver connections, air terminal device connections to ductwork, and frames for access doors.

PART 2 – PRODUCTS

2.1 SUMMARY

A. Ductwork shall be round, rectangular, or flat oval as indicated on the Drawings. Sizes given shall be considered to be minimum, and any conversion from the given shape shall be made without increasing air velocity or friction losses. All duct dimensions are net clear inside dimensions.

B. Low pressure supply, return and toilet exhaust ductwork shall be constructed, reinforced and sealed for Class A seals at 2” w.g. pressure and 2000 FPM velocity, unless otherwise noted.

2.2 HANGERS AND SUPPORTS

A. Duct hangers and supports shall be in accordance with the specification Section titled, “Hangers and Supports,” and the referenced SMACNA Standards, except:

1. Hangers shall be spaced not over 8'-0" on centers.
2. For rectangular ducts with longest dimensions up through 60", hangers shall be the galvanized steel strap type. For rectangular ducts with longest dimensions 61" and larger, hangers shall be the trapeze type constructed of galvanized steel angles with round galvanized steel hanger rods. Sizes for strap hangers, trapezes angles, and hanger rods shall be based on duct size scheduled in the SMACNA Standard for strap hangers and for trapeze hangers.
3. For round ducts, hangers shall be the galvanized steel strap type. Sizes and numbers for strap hangers shall be based on duct size scheduled in the SMACNA Standard. For duct sizes requiring two (2) hangers, the hanger supports shall be minimum 3/8" round galvanized steel hanger rods.

B. Steel Construction: Sheet metal ductwork installed in steel construction shall be supported from steel side beam brackets bolted or welded to the side of the beam.

C. Lower attachment fasteners which penetrate the duct shall be sheet metal screws, blind rivets, or self-tapping metal screws. All fasteners shall be covered with mastic type duct sealer to provide air tight enclosures.

D. Hangers: Galvanized sheet steel, or round, uncoated steel, threaded rod.

1. Hangers Installed In Corrosive Atmospheres: Electro-galvanized, all-thread rod or hot-dipped-galvanized rods with threads painted after installation.
2. Straps and Rod Sizes: Conform to SMACNA HVAC Duct Construction Standards, for sheet steel width and gauge and steel rod diameters.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports: Steel shapes conforming to ASTM A36.

1. Where galvanized steel ducts are installed, provide hot-dipped-galvanized steel shapes and plates.
2. For stainless steel ducts, provide stainless steel support materials.

G. Alternate materials requirements: All hangers, supports and fasteners installed in or above high-humidity and wet areas (pool, pool storage, pool equipment storage, showers, locker rooms, restrooms, etc.) shall be non-corrosive, stainless steel or aluminum.

2.3 SHEET METAL MATERIALS

A. Sheet metal ductwork materials shall be as follows:

1. Sheet metal shall be provided in proper thickness as indicated, packaged and marked as specified in ASTM A-700.

2. Galvanized sheet steel shall be of hot dipped galvanized steel of lock-forming quality, with minimum zinc coating of 1.25 ounces per square foot each side per ASTM A-527, Coating Designation G90 in accordance with ASTM A-525. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view. Dryer exhaust ductwork shall be continuous spiral round and have continuously welded, liquid-tight joints.

3. Reinforcement shapes and plates shall be of galvanized steel reinforcing where installed on galvanized sheet metal ducts unless otherwise indicated on the Drawings or elsewhere in the specifications.

4. Tie rods shall be of 1/4" minimum diameter galvanized steel for lengths of 36" or less. Tie rods shall be of 3/8" minimum diameter galvanized steel for lengths greater than 36".

2.4 RECTANGULAR AND FLAT OVAL METAL DUCTWORK

A. General: Except as otherwise indicated, fabricate rectangular and flat oval ducts with paint-grade galvanized sheet steel, in accordance with tables in SMACNA “HVAC Duct Construction Standards,” including associated details. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications, and joint types and intervals.

1. Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
2. Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

B. Cross bracing for duct sides 19" and larger & 20 gauge or less with more than 10 sq. ft. of unbraced panel area. Refer to SMACNA “HVAC Duct Construction Standards”.

C. Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA “HVAC Metal Duct Construction Standards.”

D. Formed reinforcing drives, slips, pocket locks, and standing seams shall be constructed from galvanized sheet steel. Intermediate reinforcing angles shall be of galvanized steel.

E. Turning vanes shall be installed in all 90 degree square and rectangular supply elbows and at other locations shown. The turning vanes shall be double thickness type, with vanes secured to the runners and runners secured to the duct. Elbows in round ductwork and other radiused elbows shall have an inside radius equal to the diameter of the duct.

2.5 ROUND METAL DUCTWORK

A. Ductwork is to be fabricated to conform to SMACNA “HVAC Duct Construction Standards.” Round Ductwork: Construct of paint-grade galvanized sheet steel complying with ASTM A527 by the following methods and in minimum gauges listed in SMACNA.

Diameter	Min. Gauge	Method of Manufacture
3" to 14"	26	Spiral Lockseam
15" to 26"	24	Spiral Lockseam

B. Provide locked seams for spiral duct; fusion-welded butt seam for longitudinal seam duct.

C. Round ducts up to and including 12" in diameter shall be longitudinal lock seam or spiral seam construction. Round ducts larger than 12" shall be spiral lock seam construction.

1. Girth joints in ducts up to and including 12" shall be beaded crimp type and each joint shall be fastened with sheet metal screws, equally spaced, not more than 8" on centers and with a minimum of 3 screws in each joint. The beaded crimp joint shall provide at least a 1" lap to accommodate the sheet metal screws.

2. Girth joints in ducts larger than 12" shall be the beaded sleeve type. The beaded sleeve joints shall be fabricated of the same gauge galvanized sheet steel and the sleeve joints shall be a minimum of 4" in length. Each section of duct shall be fastened to the sleeve with sheet metal screws, equally spaced, not more than 8" on centers and with a minimum of 3 screws in each section.

D. 90-Degree Tees, Laterals and Conical Tees shall be fabricated to conform to SMACNA “HVAC Duct Construction Standards,” with metal thicknesses specified for longitudinal seam straight duct.

E. All branch take-offs in ductwork shall be made with cinch-collar taps or pre-manufactured spin-in fittings with air scoop and damper (dampers above sheetrock ceilings shall be provided with remote damper operators, Young Regulator or approved equivalent) or conical lateral fittings. Diverging-Flow Fittings shall be fabricated with a reduced entrance to branch taps having no excess material projecting from the body onto branch tap entrance. Shop fabricated or saddle taps shall not be allowed.

F. Elbows shall be fabricated in die-formed, gored, or pleated construction. Fabricate the bend radius of die-formed, gored, and pleated elbows 1.5 times the elbow diameter. Unless elbow construction type is indicated, provide elbows meeting the following requirements:

1. Round Elbows (12 Inches and Smaller): Die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60 and 90 degrees only. Fabricate nonstandard bend angle configurations or 1/2 inch diameter (e.g. 3-1/2 and 4-1/2 inch) elbows with gored construction.
2. Round Elbows (Larger than 12 Inches): Gored elbows, except where space restrictions require a mitered elbow.
3. Die-Formed Elbows (for Sizes up to 12 Inches and All Pressures): 20 gauge with 2-piece welded construction.
4. Round Gored Elbows Gauges: 20 gauge with welded construction.

G. Where space conditions prohibit the use of die-formed, gored, or pleated elbows, mitered elbows may be used provided they are fabricated as follows:

1. Mitered Elbows: Fabricate mitered elbows with welded construction in gauges noted herein.

2. Mitered Elbows Radius and Number of Pieces: Unless otherwise indicated, construct elbow to comply with SMACNA “HVAC Duct Construction Standards.”

H. Adjustable elbows shall be prohibited.

2.6 FACTORY-FABRICATED LOW-PRESSURE DUCTWORK

A. General: At installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct and fittings. Duct classification shall be 1” w.g. pressure with Class “A” seals.

B. Gauge: See chart in section 2.5 (above) for gauge thickness required for round and oval ducts and fittings, 4" through 24" diameter.

C. Elbows: One piece construction for 90 degrees and 45-degree elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.

D. Divided Flow Fittings: 90-degree tees, constructed with saddle tap spot welded and bonded to duct fitting body.

E. Ductwork Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork of one of the following:

1. Semco Manufacturing, Inc.
2. United Sheet Metal Division, United McGill Corp.
3. Impulse Air.

2.7 FACTORY-FABRICATED MEDIUM-PRESSURE DUCTWORK

A. General: Medium pressure ductwork is that portion of the duct system downstream of air handling units and up to the terminal unit inlets, and shall be SMACNA Pressure Class 4" w.g. Medium pressure ductwork construction shall be spiral lock seam (round or oval) or gasketed mechanical fastened (rectangular).

B. Elbows: One piece construction for 90 degrees and 45-degree elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.

C. Divided Flow Fittings: 90-degree tees, constructed with saddle tap spot welded and bonded to duct fitting body.

D. Ductwork Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork of one of the following:

1. Semco Manufacturing, Inc.
2. United Sheet Metal Division, United McGill Corp.
3. Impulse Air.

2.8 GREASE DUCTWORK

A. Grease hood exhaust ductwork shall be 14 ga. black steel with all welded joints and seams and shall

be insulated. All elbows shall be smooth radius with center line radius equal to 1.5 duct width (mitred elbows are not acceptable). Provide code required clearances to combustible and non-combustible materials. Slope at 1" per linear foot and provide NFPA approved traps at all low points, with drain routed to drainage system. Provide access doors for cleaning and inspection at all equipment connections, all changes in direction, and at a maximum of 12 ft. on center. If the grease duct is within a vertical shaft an access door shall be provided on each floor.

2.9 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

2.10 DUCT LINER FOR DUCTWORK (NON-DOUBLE WALL)

A. General: Liner shall meet NFPA 90A and be 1” thick closed cell elastomeric foam insulation, permeated with an anti-microbial agent, with a self-adhesive internal surface in contact with the ductwork interior, on the airstream surface. Duct liner shall meet the National Board of Fire Underwriters' standards for Internal Duct Application. All duct liner shall be marked with the density, located so as to be visible on the exposed surface of the liner. Surface burning characteristics shall meet UL 723, not to exceed 25 flamespread and 50 smoke development. Thermal conductivity (k) shall not exceed 0.25 75°F mean temperature. The 250°F operating temperature limit shall be per ASTM C 411 test method. The moisture absorption of less than 3% by weight at 120°F and 90% relative humidity shall be per ASTM C 553 test method. Liner shall not promote or support fungus growth per UL 181. The liner corrosiveness shall meet ASTM C 665. Based on ASTM C 1071 and ASTM C 423 Type A mounting per ASTM E 795, the liner shall have sound absorption coefficients as follows:

Hz	125	250	500	1000	2000	4000	NRC
Sound Absorption Coefficient	.05	0.25	0.57	0.78	0.87	0.89	0.60

B. Acceptable Manufacturers: Duct liner shall be Armacell AP/Coilflex with Microban, with all joints and seams sealed with Armaflex 520 adhesive, or approved equivalent by one of the following manufacturers:

1. Owens Corning
2. Armstrong
3. Manville
4. Certainteed

2.11 SHEET METAL PLENUMS

A. Provide sheet metal plenums at air inlet and discharge locations and as indicated on the Drawings.

B. Plenums shall be constructed of minimum of 16 gauge galvanized sheet steel, formed in 1-1/2" high standing seam panels with galvanized angle iron stiffeners.

C. All plenums shall be constructed to avoid restrictions in airflow and to be rectangular in shape. Slopes shall not exceed 45˚ in angle.

D. Provide interior galvanized angle iron bracing before fan inlet and exterior galvanized angle iron bracing after fan discharge to prevent damage when fan operates.

E. Standing seams shall be on outside of casing. Seams shall be sealed with joint and seam sealant and bolted or riveted on maximum 12" centers.

F. Outside angles shall be bolted or riveted to plenum wall on maximum 12" centers.

G. Where plenum joins concrete curb at the floor line, bolt or rivet panels on maximum 12" centers to galvanized angle iron, and caulk airtight.

H. Where plenum joins other masonry, use expansion shields and bolt panels on maximum 24" centers, and caulk airtight.

I. Provide lining as specified in paragraph 3.9 (below) and as indicated on the drawings.

2.12 FLEXIBLE DUCTWORK

A. Flexible ductwork shall be Class 1, UL 181 air duct with an aluminized Mylar or polyester inner liner laminated to a corrosion resistant steel wire helix. Aluminum helix shall not be acceptable.

B. Flexible ductwork shall be equipped with a 1" thick, one (1) pound density fiberglass insulation and vinyl outer jacket shall cover over the wire helix.

C. Flexible ductwork shall be designed for pressures up to 4" w.g. for low pressure ductwork. The maximum allowable length of low pressure flexible ductwork shall be 25'-0" and shall be limited to short run-outs and end runs connected to round neck ceiling supply diffusers and sidewall registers. Provide a spin-in fitting with integral volume damper at all flexible run-out connections in low pressure ductwork.

D. Acceptable manufacturers and models of low-pressure flexible ductwork are: Atco, Flexmaster, Thermaflex or Wiremold.

2.13 SEALING MATERIALS

A. Joint and seam sealants shall be of one-part, non-sag, solvent-release-curing, polymerized butyl sealant complying with FS TT-S-001657, Type I; formulated with a minimum of 75% solids.

B. Flanged joint mastic sealants shall be of one-part, acid curing silicone elastomeric joint sealants, complying with ASTM C-920, Type S, Grade NS, Class 25.

C. Ductwork Sealant: Provide on all joints and seams in supply, return, exhaust, transfer, relief, make-up air, and outside air ductwork with non-hardening, non-migrating mastic or liquid elastic duct sealant, type applicable for fabrication and installation details, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. All ducting shall be sealed air tight with Miracle Sealer (low VOC) by the Miracle Adhesive Company, Hardcast, or United McGill.

2.14 DRYER (ELECTRIC) VENT DUCTING

A. Dryer vents shall be single wall galvanized steel flue piping, with all joints fastened with “pop rivets” and sealed with mastic. The use of screws to fasten dryer vents is strictly prohibited.

B. Unless specifically indicated on the drawings otherwise, all dryer exhaust ductwork shall be round with smooth radius elbows (rectangular duct and mitered elbows are not acceptable). Provide dryer discharge boxes behind dryer at mounting height to properly fit the dryer to be provided. Coordinate exact locations and mounting with the Architect.

C. Provide dryer vent caps for wall mounted exhaust ports. Wall exhaust caps (steel) to have sound dampening rubber stops and primer coat for finish painting in the field. Wall exhaust caps to be as manufactured by SEIHO, or approved equivalent. Finish and style shall be selected by Architect.

PART 3 – EXECUTION

3.1 GENERAL

A. Contractor shall not fabricate and/or install ductwork until Architect has reviewed shop drawings for compliance with engineer design concept.

B. Any ductwork fabricated and/or installed prior to the Architect’s review found to be in non-compliance shall be removed or corrected as per instructions from Architect at Contractor’s expense.

C. Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (3% leakage for systems rated at their static pressure ratings specified above; SMACNA standard duct leakage tests shall be performed on the Make-Up Air Unit and Pool Dehumidification Unit ductwork); and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, angle iron supports, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. All ducting shall be sealed air-tight. Ductwork shall be properly braced and guyed to prevent lateral or horizontal swing.

3.2 FABRICATION

A. Shop fabricate ductwork in 4, 5, 8, 10 or 12-ft lengths, unless otherwise indicated or required to complete runs. Preassemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

B. Shop fabricate ductwork of gauges and reinforcement complying with SMACNA "HVAC Duct Construction Standards". All duct sizes indicated are clear inside dimensions, provide proper allowance for duct liner as required.

C. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate round elbows with center-line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.

D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to section 23 33 00, "Duct Accessories" for accessory requirements.

E. Ductwork shall be constructed in conformance with the requirements of the SMACNA "HVAC Duct Construction Standards". Where the requirements of the Drawings and/or specifications exceed the requirements of the SMACNA Manual, the requirements of the contract documents shall govern.

1. Low pressure ductwork shall be constructed for a minimum of 2” w.g. with 2” w.g. reinforcement with Class “A” seals.
2. Secondary air systems (Systems with less than 5 tons cooling capacity and exhaust air systems): supply air ductwork from the units, all return and transfer air ductwork, relief air, and toilet exhaust ductwork shall be constructed for a minimum of 1” w.g. with 1” w.g. reinforcement and Class “A” seals.
3. Outside air intake ductwork from the exterior walls to and the associated units, and plenums at louvers, shall be constructed for a minimum of 1” w.g. with 1” w.g. reinforcement with Class “A” seals.
4. Dryer exhaust ductwork shall be constructed for a minimum of 2” w.g.

F. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.

3.3 INSPECTION

A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.4 HANGING AND SUPPORTING

A. Install rigid round, rectangular, and flat oval metal duct with support systems indicated in SMACNA “HVAC Duct Construction Standards,” Tables 4-1 through 4-3 and Figures 4-1 through 4-8.

B. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection

C. Support vertical ducts at a maximum interval of 16 feet and at each floor.

D. Upper attachments to structures shall have an allowable load not exceeding 1/4 of the failure (proof test) load but are not limited to the specific methods indicated.

E. Install powder actuated concrete fasteners after concrete is placed and completely cured. Use of powder actuated fasteners only allowed if approved by the Architect in writing.

3.5 GENERAL INSTALLATION

A. Install all ductwork and accessories as shown and in accordance with applicable SMACNA standards.

B. All joints in ductwork shall be sealed with a fire retardant duct sealant.

C. Sound-proof construction for duct penetrations shall be required for openings between ductwork and following construction:

1. Equipment room walls.
2. Floors, except in shafts.

D. Sound proofing installation shall include:

1. Fill openings with fibrous glass blanket for full depth of penetration.
2. Caulk each side of opening with non-hardening, non-aging plenum rated caulking compound.

E. Install ducts with the fewest possible joints.

F. Use fabricated fittings for all changes in directions, changes in size and shape, and connections.

G. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.

H. Provide transitions to connect ductwork to equipment and coils.

I. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

J. Non-Fire-Rated Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on all 4 sides by at least 1-1/2 inches.

K. Use galvanized hard round ductwork in the same size as flexible ductwork for runouts to diffusers longer than 7 ft.

L. Duct system shall be properly supported and reinforced (externally and internally as required by SMACNA Standards) to eliminate rattles, drumming and sagging.

M. Provide balancing devices, (dampers, extractors, remote damper operators, etc.) to achieve design air flows as required to perform the required Test and Balance per the T&B contractor.

N. Maintain clean work environment during progress of work and seal all open ends of ducts after installation to prevent contamination from dirt, debris and other foreign matter inside ductwork.

O. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally to the building lines and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, columns, and other permanent enclosure elements of building. Ductwork shall be installed tight to the structural overhead components. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 2" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with structure, hoods, suspended ceiling, lighting layouts, HVAC and plumbing piping, fire protection piping, electrical conduit and similar finished work.

P. Penetrations: Where ducts pass through interior partitions and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and substrate. Where ducts pass through fire-rated floors, ceilings, walls, or partitions, provide firestopping between duct and substrate.

Q. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

R. Installation: Install metal ductwork in accordance with SMACNA" HVAC Duct Construction Standards". Seal all joints with duct sealer. Contractor shall paint the duct and/or insulation, flat black behind the face of the grilles.

S. Cover all openings in ductwork at the end of each work day with plastic secured to ductwork to keep dirt and debris out of the system.

3.6 ROUND DUCTWORK

A. Round ducts up to and including 12" in diameter shall be longitudinal lock seam construction. Round ducts larger than 12" shall be spiral lock seam construction (except for dryer exhaust).

1. Girth joints in ducts up to and including 12" shall be beaded-crimp type and each joint shall be fastened with sheet metal screws, equally spaced, not more than 8" on centers and with a minimum of three (3) screws in each joint. The beaded-crimp joint shall provide at least a 1" lap to accommodate the sheet metal screws.
2. Girth joints in ducts larger than 12" shall be the beaded sleeve type. The beaded sleeve joints shall be fabricated of the same gauge galvanized sheet steel and the duct shall be a minimum of 4" in length. Each section of duct shall be fastened to the sleeve with sheet metal screws, equally spaced, not more than 8" on centers and with a minimum of three (3) screws in each section.

3.7 SEAM AND JOINT SEALING

A. General: Seal all duct seams and joints for less than 3% leakage as follows:

1. Pressure Classifications Greater Than 3 Inches Water Gauge: All transverse joints, longitudinal seams, and duct penetrations.
2. Pressure Classification 2 and 3 Inches Water Gauge: All transverse joints and longitudinal seams.
3. Pressure Classification Less than 2 Inches Water Gauge: All transverse joints and longitudinal seams.

B. Seal externally insulated duct joints prior to insulation installation.

3.8 INSTALLATION OF FLEXIBLE DUCTWORK

A. The maximum allowable length of low pressure flexible ductwork shall be 25'-0" and shall be limited to short run-outs and end runs connected to round neck ceiling supply diffusers. Provide a spin-in fitting with air scoop and integral volume damper at all flexible run-out connections in low pressure ductwork unless noted otherwise on the drawings. Flexible ductwork shall not be used to make more than one 90° bend in its length. Splicing flexible ducts shall NOT be done; all flex ducting shall be continuous from beginning to end.

3.9 INSTALLATION OF DUCT LINER

A. Duct liner shall have self-adhesive internal surface for contact with the ductwork interior. Sections shall be joined by coating the edges with Armaflex 520 low VOC adhesive, or equivalent. Secure liner to duct system with self-adhering pins adhered to clean surface and secure with self-locking

washers, space pins not more than 4" from the edges and not more than 16" on centers. Lining shall meet National Board of Fire Underwriters' standards for Internal Duct Application. All duct liner shall be marked with the density located so as to be visible on the exposed surface of the liner Air friction correction factor shall not exceed 1.40 at 2000 FPM and 1.5 at 4000 FPM. Duct liner shall be provided on ductwork systems as follows:

1. All return air, relief air, and transfer air ductwork.
2. Supply air ductwork shall be lined from air handling equipment (RTU, AHU, FCU, Fan, etc.) discharges through the first horizontal elbow or through the first twelve (12) feet, whichever is greater.
3. All new low pressure supply air ductwork serving conference type areas (meeting, conference, training rooms, etc.) shall be lined.
4. Other ductwork as indicated on the drawings.

3.10 CONNECTIONS

A. Equipment Connections: Use flexible connectors in accordance with Division 23 Section 23 33 00, “Air Duct Accessories”.

B. Branch Connections: Comply with SMACNA “HVAC Duct Construction Standards.”

C. Outlet and Inlet Connections: Comply with SMACNA “HVAC Duct Construction Standards.”

3.11 CLEANING AND ADJUSTING

A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Adjust volume control devices as required by the testing and balancing procedures to achieve required air flow. Refer to Section 23 05 93, “Testing, Adjusting and Balancing” for requirements and procedures for adjusting and balancing air systems. Seal or repair any leaks in ductwork that become apparent in balancing process.

C. The ductwork is to be clean and free of dust, dirt, debris and other foreign matter at the time of final acceptance. During construction, ducts shall be protected at the end of each day with plastic secured over all duct openings. Ducts containing dirt and debris shall be thoroughly cleaned prior to air movement.

END OF SECTION 233113

SECTION 233300 – AIR DUCT ACCESSORIES

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. This section of the specifications and related drawings describe the requirements pertaining to the duct accessories for heating, cooling and ventilating including but not limited to the following:

1. Manual Dampers and Damper Hardware.
2. Fire Dampers.
3. Fire/Smoke Dampers.
4. Motor Operated Dampers.
5. Backdraft Dampers.
6. Duct Access Doors.
7. Flexible Duct Connections.

B. Extent of the ductwork is indicated on the Drawings and by the requirements of this section.

C. The construction requirements herein shall include appurtenant structures and buildings to which the ductwork is to be installed.

1.2 QUALITY ASSURANCE

A. All duct accessories shall comply with requirements as specified in this section of these specifications.

B. All duct accessories furnished and installed under this section of these specifications shall be new and in first class condition.

C. All duct accessories furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor’s expense.

D. Comply with the follow Codes and Standards:

1. SMACNA "HVAC Duct Construction Standards, Metal and Flexible", for fabrication and installation of metal ductwork.
2. ASHRAE Handbook, Equipment Volume, Chapter "Duct Construction," for fabrication and installation of metal ductwork.
3. Construct air duct in accordance with UL Standard 181.
4. NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems."
5. NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

E. Codes and regulations (i.e. - SMACNA Duct Construction and Installation Standards) referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

F. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for ductwork materials and products.

B. Ductwork fabrication shop drawings (shop standards) shall be submitted as part of the shop drawing submittal.

C. Shop Drawings: Submit 1/4” = 1’-0” scale layout drawings of ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Duct locations, sizes and proportions shown shall be followed as nearly as practicable. However, locations and width by height ratio of ducts may be changed a reasonable amount to fit the job conditions at no additional cost to the Owner. Show interface and spatial relationship between ductwork and proximate equipment. Note on the shop Drawings any unresolved point of interference. Show modifications of indicated requirements, made to conform to local shop practice, and how these modifications ensure that free area, materials, and rigidity are not reduced.

D. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Sections 23 05 00 and 23 05 01.

E. Maintenance Data: Submit maintenance data and parts lists for ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Section 23 05 01.

1.4 DELIVERY, STORAGE AND HANDLING

A. Protection: Prevent end damage and protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, handling.

B. Deliver materials to job site in new first class condition. Rusted, soiled and/or contaminated ductwork shall not be permitted for use.

C. Store duct accessories utilizing suitable means so as to protect from weather, construction work traffic and contamination. Where duct accessories are stored outdoors, Contractor shall cover in a suitable manner to prevent water, dirt, mud and/or debris from entering. Duct accessories shall not be laid on grade for storage.

D. Duct accessories found to be contaminated with water, dirt, mud and/or other debris shall be cleaned and restored to new condition to the satisfaction of the Architect. Contaminated duct accessories shall not be used until inspected.

E. Rusted duct accessories shall not be used and shall be removed from the job site at the Contractor’s expense.

1.5 DEFINITIONS

A. SMACNA Standards indicated shall be defined as standards published by the Sheet Metal Contractor’s National Association, Inc.

B. Seams: The joining of two (2) longitudinally (same direction as airflow through ductwork) oriented edges of sheet metal ductwork material occurring between two (2) transverse joints.

C. Joints: Transverse (girth of ductwork) joints, branch intersections, tap collars, louver connections, air terminal device connections to ductwork, and frames for access doors.

PART 2 - PRODUCTS

2.1 MANUAL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide manual volume dampers, manufactured by one manufacturer for all dampers on project, from one of the following:

1. Arrow Industries
2. Greenheck
3. Louvers and Dampers, Inc.
4. Ruskin

B. Low Pressure Manual Dampers: Provide dampers of single blade type or multi-blade type to allow for proper air balancing per AABC/NEBB Standards, constructed in accordance with SMACNA "HVAC Duct Construction Standards." Dampers shall be single blade butterfly type in ducts up to and including 18" x 12" size; for ducts larger than 18" x 12", in either or both dimensions, the dampers shall be the opposed multi-blade type. Single blade butterfly dampers shall be constructed of not less than 16 gauge galvanized steel blade mounted in a galvanized steel frame. For rectangular dampers, the top and bottom edges of the blade shall be crimped to stiffen the blade. Damper shall be provided with an extended rod to permit installation of a damper regulator. Dampers larger than 12" in either direction shall be multi-blade dampers and shall be the opposed blade type, constructed of not less than 16 gauge galvanized steel blade mounted in galvanized steel channel frame. Blade spacing shall not exceed 6" and the top and bottom edges of the blade shall be crimped to stiffen the blades. Damper blades shall be interconnected by rods and linkages to provide simultaneous operation of all blades. Damper shall be provided with an extended rod to permit installation of a damper regulator.

C. Splitter Dampers: Shall be constructed of galvanized sheet steel two (2) gauges heavier than ductwork in which installed but not less than 20 gauge galvanized steel sheet. The length of the damper blade shall be the same as the width of the widest duct section at the split, but in no case shall blade length be less than 12".

D. Spin-in fittings: Provide spin-in fittings WITH air scoop and manual butterfly damper with lever arm adjustment and locking wing nut.

2.2 DAMPER HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide duct hardware, manufactured by one manufacturer for all items on project, from one of the following:

1. Duro-Dyne.
2. Ventfabrics, Inc.
3. Young Regulator Co.

B. Hardware for Manual Dampers:

1. Splitter damper hardware - When neither dimension of a damper exceeds 18", the damper shall be provided with a ball joint bracket attached to the outside of the duct. The bracket shall have a set screw for securing damper rod in position. The damper operating rod shall be not less than 3/8" diameter steel rod and shall be secured to the damper blade with a clip. When either dimension of a damper exceeds 18", the damper shall be provided with 2 ball joint brackets and rods. The rods shall be located at quarter points on the damper.
2. Duct mounted regulators with operating handle and locking quadrant shall be provided on manual volume control dampers.

C. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

2.3 TURNING VANES

A. Manufacturer: Subject to compliance with requirements, provide turning vanes from one of the following manufacturers:

1. Aero Dyne Company
2. Airsan Corporation
3. Anemostat Products Division; Dynamics Corporation of America.
4. Barber-Colman Company
5. Duro-Dyne Corporation
6. Environmental Elements Corporation
7. Hart & Cooley Manufacturing Company
8. Register & Grille Manufacturing Company, Inc.
9. Tuttle and Bailey

B. Manufactured Turning Vanes: Provide double thickness turning vanes constructed of 1-1/2" wide curved blades set on 3/4" centers, supported with bars perpendicular to blades set on 2" centers, and set into side strips suitable for mounting in ductwork.

C. Fabricated Turning Vanes: Provide fabricated double thickness turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards."

2.4 FIRE DAMPERS/RADIATION DAMPERS

A. Manufacturer: Subject to compliance with requirements, provide dampers from one of the following manufacturers:

1. Air Balance, Inc.
2. Arrow Louver and Damper
3. Greenheck
4. Louvers and Dampers, Inc.
5. Nailor Industries
6. Ruskin
7. Prefco Products, Inc.
8. Lloyd Industries

B. Fabricated Fire Dampers: Provide dampers constructed in accordance with SMACNA "Fire Dampers and Heat Stop Guide."

C. Fire dampers shall be provided at all penetrations through fire rated walls, ceilings, and partitions except when specifically exempted by code. Fire dampers shall be UL labeled and shall be Type B (blades out of the air stream) or Type C (round duct or flat oval duct).

D. Fire Dampers for Rectangular Duct: Provide UL 555 listed, Type B fire dampers, of sizes indicated. Construct casings of 22-ga galvanized steel. Provide fusible link rated at 160 to 165 degrees Fahrenheit (71 to 74 degrees Celsius) unless otherwise indicated. Provide damper with positive lock in closed position, and with the following additional features:

E. Curtain type damper blade assembly.

F. Steel, match casing blade material.

G. Fire Dampers for Round or Flat Oval Duct: Provide UL 555 listed, type C fire dampers, of sizes indicated. Construct casings of 22-ga galvanized steel. Provide fusible link rated at 160 to 165 degrees Fahrenheit (71 to 74 degrees Celsius) unless otherwise indicated. Provide damper with positive lock in closed position, and with the following additional features:

1. Curtain type damper blade assembly.
2. Steel, match casing blade material.

2.5 FIRE/SMOKE DAMPERS AND SMOKE DAMPERS

A. Manufacturer: Subject to compliance with requirements, provide dampers from one of the following manufacturers:

1. Air Balance, Inc.
2. Arrow Louver and Damper
3. Greenheck
4. Louvers and Dampers, Inc.
5. Nailor Industries
6. Ruskin
7. Prefco Products, Inc.
8. Leader Industries

B. Basis of design for combination fire/smoke dampers: Ruskin FSD60 for standard ducted applications, Ruskin FSD60FA for flush mounted applications requiring front access. Basis of design includes 120V powered electric motor actuators by same manufacturer.

C. Fire/smoke dampers (FSD) shall be UL 555S listed and shall close in event of excessive temperatures and shall also close when a signal from the smoke detection system is received. Fire/smoke dampers (FSD) shall be UL 555S listed and meet a low leakage rating of eleven (11) cfm per sq. ft. Fire/smoke dampers shall be of non-heat degradable design with friction free metal-to-metal seals incorporated integral resettable and reusable UL listed electric-ambient temperature link, UL listed releasing device/mechanical lock assembly.

D. The link shall be activated by either electric signal from the fire alarm circuit or by associated zone air handling unit’s duct detector or local duct detector near damper to permit the damper to close and lock independent of the motor actuator position. Upon cessation of the alarm condition or normalization of air handler detector, the link shall return to its reset position enabling the damper to be fully recycled automatically by the actuator.

E. Electric motor actuators shall be UL listed and furnished with all necessary mounting and location hardware from the factory for installation outside of the ductwork. The actuators shall be power open/spring closed operation. The combination smoke/fire dampers shall be furnished with connecting shafts and linkage utilizing not more than one actuator for single and multiple (except for damper height) sections assembly sized up to 23 sq. ft.

F. Smoke dampers shall be the same as noted above except the fusible link is omitted.

2.6 MOTOR OPERATED DAMPERS

A. Automatic dampers shall have blades not over 6" wide and 36" long, heavy channel frames and non-corrosive sleeve type bearings, and shall be furnished by the control manufacturer (except for dampers furnished with air handling equipment). All dampers opening to outside shall have air tight edge seals and end seals.

B. Dampers specified for proportioning (modulating) service shall be opposed-blade type, with double-thickness extruded aluminum blades with an approximate airflow cross-section.

1. Linkage shall be outside of airstream.
2. Blades shall seat against continuous resilient seals. When fully closed, leakage shall not exceed 6 CFM per square foot, as measured inside damper frame, at pressure difference of 2 inches w.g.

C. Dampers for 2-position service shall be parallel-blade type with #16 gauge blades.

D. Damper operators shall position the controlled device positively and accurately. Operators shall provide not less than 7.5 inch-pounds torque per square foot of damper area to the damper drive shaft.

E. Damper actuators shall be of the push-pull or rotary type for modulating, 3-point floating, or 2-position control as required by the application. The actuator shall use an overload-proof synchronous motor or an electric motor with end switches to de-energize the motor at the end of the stroke limits. Dampers for elevator shaft smoke relief shall automatically reset to the closed position upon clearing of the fire alarm condition and NOT require a manual reset on the damper actuator.

2.7 BACKDRAFT DAMPERS

A. Manufacturer: Subject to compliance with requirements, provide backdraft dampers from one of the following manufacturers:

1. Air Balance, Inc.
2. Arrow Louver and Damper
3. Greenheck
4. Louvers and Dampers, Inc.
5. Nailor Industries
6. Ruskin
7. Leader Industries

B. Backdraft dampers shall have blades not over 6" wide and 36" long. Frame shall be extruded aluminum, .090" wall thickness minimum, with mitered corners. Blades shall be of formed aluminum, .025" thickness minimum, with vinyl edge seals. Bearings shall be non-corrosive material, requiring no lubrication. Linkage shall be aluminum tie-bars concealed within frame. Counterbalance shall be zinc-plated bar on blades (except top blade), and shall be field adjustable to provide proper operation. Maximum size of single section shall not exceed 36" wide x 48" high. For sizes larger than 36" wide x 48" high, multiple sections shall be assembled to provide a rigid installation.

C. Backdraft Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to close when fan is off. Construct blades of 16 gauge aluminum, provide 1/2" diameter ball bearings, 1/2" diameter steel axles spaced on 9" centers. Construct frame of 2" x 1/2" x 1/8" steel channel for face areas 25 sq. ft. and under; 4" x 1-1/4" x 16 gauge channel for face areas over 25 sq. ft. Provide galvanized steel finish on frame with aluminum touch-up.

2.8 DUCT ACCESS DOORS

A. Manufacturer: Subject to compliance with requirements, provide duct access doors from one of the following manufacturers:

1. Air Balance, Inc.
2. Duro-Dyne Corporation
3. Nailor Industries
4. Register & Grille Manufacturing Company, Inc.
5. Ruskin
6. Ventifabrics, Inc.
7. Zurn Industries, Inc.; Air Systems Division

B. Access doors shall be of size to provide proper access. Access doors 18" x 18" and larger shall have a continuous hinge on each side with latch on the other side. Access door shall be designed for five (5) times the pressure of the duct in which it is mounted. Access doors shall be of sufficient size to provide access to the dampers for resetting or replacing thermal links. Access doors downstream of fire dampers in medium pressure ductwork shall be the implosion type.

C. Construction: Construct of same or greater gauge as the ducts, casing, housing, or plenum in which they are installed. Provide insulated doors for insulated ductwork consisting of 1/2" thick rigid insulation between the double walled panel construction. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide for supply, return, outside, exhaust and transfer air one side hinged, other side with one handle-type latch for doors 12" high and smaller, 2 handle-type latches for larger doors. Provide doors complete with all necessary hardware including extended frames, felt gaskets, hinges and handles.

2.9 FLEXIBLE DUCT CONNECTIONS

A. Manufacturer: Subject to compliance with requirements, provide flexible connections of one of the following:
1. American/Elgen Company
2. Duro-Dyne Corporation
3. The Flexaust Company
4. Ventfabrics, Inc.

B. Flexible duct connections shall be non-combustible, constructed of glass fabric, double coated with neoprene (30 oz. Per square yard minimum) 3" long, crimped into galvanized sheet steel, and provided with proper end connections for attachment to duct and equipment.

PART 3 – EXECUTION

3.1 GENERAL

A. Contractor shall not fabricate and/or install ductwork until Architect has reviewed shop drawings for compliance with engineer design concept.

B. Any ductwork fabricated and/or installed prior to the Architect’s review found to be in non-compliance shall be removed or corrected as per instructions from Architect at Contractor’s expense.

3.2 INSPECTION

A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.3 GENERAL INSTALLATION

A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in the SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

B. Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated.

C. Install ducts with the fewest possible joints. All joints in ductwork shall be sealed with a fire retardant duct sealant. Tape shall not be acceptable.

D. Use fabricated fittings for all changes in directions, changes in size and shape, and connections. Provide transitions to connect ductwork to equipment and coils.

E. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.

F. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; insofar as practical, avoid diagonal runs. Install duct systems in shortest route that does not obstruct useable space or block access for servicing building and its equipment.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Where possible, provide clearance of 1 inch where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any.

I. Where possible, install insulated ducts with 1-inch clearance outside of insulation.

J. Coordinate with structure, lighting, piping, hoods, and other equipment. Duct sizing and routing is intended to allow for electrical fixtures, conduit, and plumbing drains. If clearance cannot be achieved in particular cases, coordinate to ensure that other trades work can be installed in available space.

K. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

L. Non-Fire-Rated Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1-1/2 inches.

M. Sound proof construction for duct penetrations shall be required for openings between ductwork and following construction:

1. Equipment room walls.
2. Floors, except in shafts.

N. Install sound proof construction for ducts penetrating all non-rated walls by filling openings around ductwork with fibrous glass blanket or board for full depth of wall penetration. Caulk each side of the penetration with fire-rated non-hardening, non-aging caulking compound.

O. Use round ductwork same size as flex for runouts to diffusers.

P. Duct system to be supported and stiffened to eliminate rattles, drumming and sagging.

Q. Provide balancing devices, (dampers, extractors, etc.) to achieve design air flows.

R. Maintain clean work environment during progress of work to prevent dirt, debris and other foreign matter from being introduced inside ductwork.

3.4 INSTALLATION OF MANUAL DAMPERS

A. Install manual damper at each branch take-off on low pressure ductwork.

B. Install manual damper at all air distribution devices unless scheduled otherwise on the drawings.

3.5 INSTALLATION OF TURNING VANES

A. Install turning vanes in accordance with SMACNA "HVAC Duct Construction Standards."

B. Install double thickness turning vanes in square or rectangular 90 degree elbows in supply air systems, and elsewhere as indicated.

3.6 INSTALLATION OF FIRE DAMPERS

A. Fire dampers shall be installed at all duct penetrations through fire rated walls and partitions except where exempt by code.

B. Install access doors on entering air side of fire dampers to facilitate maintenance and ceilings and/or wall for proper access.

C. Install fire dampers in accordance with manufacturer’s printed installation instructions.

3.7 INSTALLATION OF MOTOR OPERATED DAMPERS

A. Motor operated dampers shall be installed at all locations indicated on the drawings and where required to provide proper control of the air systems.

B. Damper motors (actuators) shall be installed for moving dampers from open to closed positions, or for modulating the dampers, as required by the control system. Outside air intake dampers shall fail in the closed position.

C. Install dampers in accordance with manufacturer’s printed installation instructions.

3.8 INSTALLATION OF FIRE/SMOKE DAMPERS

A. Combination fire/smoke dampers and smoke dampers shall be installed at all duct penetrations through smoke/fire rated walls and partitions and smoke partitions (for smoke dampers) except where exempt by code.

B. Combination fire/smoke dampers and smoke dampers shall be installed with electric motors for moving dampers from open to closed positions. Power for motors shall come from nearest power circuit. Dampers shall fail in the closed position.

C. Install access doors on entering air side of combination fire/smoke dampers to facilitate maintenance and ceilings and/or wall for proper access.

D. Install combination fire/smoke dampers and smoke dampers in accordance with manufacturer's printed installation instructions.

3.9 INSTALLATION OF BACKDRAFT DAMPERS

A. Backdraft dampers shall be installed at all exhaust fans and other locations as indicated on the drawings.

B. Install backdraft dampers in accordance with manufacturer's printed installation instructions.

3.10 INSTALLATION OF DUCT ACCESS DOORS

A. Access doors shall be installed in ducts, casings, housings, plenums, and at each vaned elbow or tee, to provide access to each volume damper, fire damper, smoke damper, combination fire/smoke damper, duct mounted coil, humidifier, flow measuring station and duct mounted control device. Access doors shall be of size to provide proper access. Access doors shall be installed so as to provide access to the dampers for resetting or replacing thermal links. Install implosion type access doors downstream of fire dampers in medium pressure ductwork.

B. Install access doors on the suction side of fans to open outward and on the discharge side of fans to open inward.

C. Install manway access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

D. Install access doors in accordance with manufacturer's printed installation instructions.

E. Coordinate the location of duct access doors with the Architectural Drawings. Duct access doors above inaccessible ceilings shall not be acceptable unless approved by the Architect prior to installation.

3.11 INSTALLATION OF FLEXIBLE DUCT CONNECTIONS

A. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibration of connected equipment. Provide duct supports on each side of flexible connections.

B. Install at all belt-driven equipment, wherever ductwork connects to vibration isolated equipment, and where shown on the drawings.

3.12 CONNECTIONS

A. Equipment Connections: Connect equipment with flexible connectors in accordance with the requirements of this section and the specific equipment specification section, as well as the manufacturer recommendations.

B. Comply with SMACNA "HVAC Duct Construction Standards" for these connection types:

1. Branch Connections.
2. Outlet and Inlet Connections.
3. Terminal Unit Connections.

3.13 FIELD QUALITY CONTROL

A. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating.

B. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

3.14 ADJUSTING AND CLEANING

A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.

1. Final positioning of balancing and manual dampers is specified in Section 23 05 93, "Testing, Adjusting, and Balancing".

B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

C. The ductwork is to be clean and free of dust, dirt, debris and other foreign matter at the time of final acceptance.

END OF SECTION 233300

SECTION 233416 – HVAC FANS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of the work is indicated on the Drawings and schedules and by the requirements of this section.

B. The construction requirements herein shall include appurtenant structures and buildings to which the system is to be installed.

C. Fans shall be provided to meet the minimum capacities scheduled at the indicated conditions and shall meet all constraints of construction and shall comply with all Specification Sections.

1.2 QUALITY ASSURANCE

A. Mechanical equipment (including supporting racks, curbs and equipment tie-downs), and the attachment of these elements to one another or to the supporting building structure, shall be designed to resist the wind pressures required by the Florida Building Code, Building; and the Florida Building Code, Mechanical, Section 301.15. design shall be by a Florida licensed professional engineer. the design and inspection of these components shall be by others as they are not part of the primary structural system of the building.

B. All fans installed on roof and/or mounted outdoors are to be Miami-Dade Certified and High-Wind Rated.

C. All fans shall comply with requirements as specified in this section of these specifications.

D. All fans furnished and installed under this section of these specifications shall be new and in first class condition.

E. All fans furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor’s expense.

F. Fans shall be tested and rated in accordance with the Air Moving and Conditioning Association, Inc. Standard No. 210, Test Code for Air Moving Devices and bear the AMCA Seal.

G. Ratings shall bear AMCA Certified Rating Seal.

H. Drive Selection: Refer to schedule on drawings for type drive and the information on Belt Drives in specification Section 23 05 01. Belts and pulley shall be furnished, as necessary, to deliver scheduled airflow capacities.

I. Motor Selection: For each fan motor, rated motor horsepower shall be not less than brake horsepower required at scheduled capacity plus ten percent (10%). All motors shall be high efficiency type and indicated clearly in the submittal package for review and approval.

J. Codes and Standards:

1. Provide fans which have been tested and rated for air and sound performance in accordance with AMCA standards, and bear AMCA Certified Rating Seal.
2. Provide fans which are designed, manufactured, and tested in accordance with Underwriters Laboratories (UL).
3. Provide motors and electrical accessories complying with NEMA standards.

K. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

1.3 SUBMITTALS AND COORDINATION

A. Product Data: Submit manufacturer's catalog data, performance curves (indicating performance and various brake horsepower and static pressures with selection points clearly indicated), and installation and start-up instructions.

B. Shop Drawings: Submit assembly type shop drawings indicating dimensions, weights, and required clearances.

C. Submit maintenance data and parts lists for each fan. Include "trouble-shooting" maintenance guides. Include this data in maintenance manual.

D. The products of a particular manufacturer has been used as the basis of design in preparation of these documents. Any modifications to the mechanical systems and their components, the electrical systems, the building structure and its Architect/Engineer, or any other portion of the building that result from the use of any product other than the basis of design equipment shall be coordinated with all other trades. Such coordination shall occur before delivery of products from the manufacturer (before shop drawing submittals) and shall be clearly indicated on the shop drawings. Any related modifications shall be performed without any additional cost to the Contract. For additional information, refer to fan schedules on drawings.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in new and in first class condition.

B. Store fans utilizing suitable means so as to protect from weather, construction work traffic and contamination. Where fans are stored outdoors, Contractor shall cover in a suitable manner to prevent contamination from water, dirt, mud and/or debris. Fans shall not be laid on grade for storage.

C. Fans found to be contaminated with water, dirt, mud and/or other debris shall be cleaned and restored to new condition to the satisfaction of the Architect. Contaminated fans shall not be used until inspected. Fans determined to be unsuitable for use by the Architect or Engineer, equipment shall not be used and shall be removed from the job site at the Contractor’s expense.

1.5 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide fans from one of the following manufacturers:

1. Greenheck
2. Loren Cook Company
3. Penn Barry Ventilator Company

PART 2 – PRODUCTS

2.1 GENERAL

A. Refer to the equipment schedules on the drawings for additional information.

B. V-belt drives shall be designed for not less than 150% of connected driving capacity and motor sheaves shall be adjustable to provide not less than 20% speed variation. Sheaves shall be selected to drive the fan at a speed to produce the scheduled capacity indicated on the Drawings when set at the approximate midpoint of the sheave adjustment. Motors with V-belt drives shall be provided with adjustable bases.

C. Provide disconnect switches and motor starters for all fan drives.

D. Motors shall be open drip-proof, selected to operate continuously at 104°F ambient without tripping of overloads. Motors shall have a +/- 10% voltage utilization range to protect against voltage variation. Provide motors having minimum efficiencies per NEMA Premium efficiency electric motor guidelines, measured in accordance with IEEE Standard 112, Test Method B. Motors shall be compatible with variable frequency drives, as applicable.

E. Roof-mounted fans shall be waterproof design so that water cannot enter the building through the fan housing, whether or not the fan is operating.

F. Centrifugal fan wheels shall be statically and dynamically balanced.

G. Each suspended fan shall be isolated from structure, refer to Section 23 05 29.

H. Where fan inlet or discharge is open to room and bottom of fan frame is less than 8'-0" above floor level, provide approximately 1/2" mesh screen guard.

I. Fans shall be installed so as to maintain manufacturer's recommended clearance from inlets to obstructions.

J. Construct fan housing of heavy steel with slip joint inlets and outlets. Rivet blades to steel shroud.

K. Factory paint fans with one coat of rust-resistant paint.

L. Provide fans with a solid hot-rolled-steel shaft ground accurately for a smooth bearing fit.

M. Mount relubricable, anti-friction, self-aligning, pillow block ball bearings on Class I fans and spherical roller type bearings on Class II and III fans. Position supports to directly oppose drive belt tensions and transmit loads to the fan base.

1. Bearings to have a minimum AFBMA 1-50 life in excess of 200,000 hours for operating conditions.

N. Mount motor on an adjustable slide rail on a steel isolation base.

O. Provide steel fan base for Arrangement 9 and 10 fans. Fan base for Arrangement 3 fans to be provided under the Vibration Isolation Section. Bases shall be prime-coat painted.

P. Select fans with outlet velocities not to exceed those scheduled and wheel diameters of same size as those scheduled.

Q. Bearings in fans and motors above ceiling to be lifetime lubricated and sealed.

R. Provide OSHA-approved expanded metal belt guards with aligned opening for checking fan shaft speed.

2.2 IN-LINE CABINET FANS

A. Description: Fans shall be direct drive, in-line configuration. Housings with integral formed inlet and outlet flanges for installation in flanged ductwork. Designed to be suspended in ductwork, hung horizontally with brackets and isolators. Fans to be UL listed and to bear the AMCA Certified Ratings Seal for air performance. Motors with open drip proof, as indicated on the schedule.

B. Construction features and accessories:

1. Fan wheel: Aluminum, centrifugal, forward curved fan wheel, statically and dynamically balanced.

2. Integral back-draft damper shall be chatter-proof.

3. Motors: Direct drive, high efficiency type matched to the fan load. Motors shall be electrically commutated (EC) type with integral potentiometer or PSC type with separate fan speed controller, mounted at fan (not on wall), for balancing purposes.

4. Galvanized steel housing with access doors for accessing the fan.

5. Fans shall be provided with cord, plug, and receptacle inside the housing. Entire fan, motor and wheel assembly shall be removable without disturbing the housing. Fan motors shall be suitably grounded and mounted on vibration isolators.

6. Neoprene or spring isolators for hanging installations.

2.4 CENTRIFUGAL DOWNBLAST ROOF FANS

A. Centrifugal roof fans shall be downblast direct drive type as indicated on drawings in the Fan Schedule. Ventilator housings shall be of one-piece heavy gauge spun aluminum construction and shall be weatherproof and incorporate an integral weather shield. Ventilators shall be mounted on curbs as described elsewhere in this specification. Fan wheels shall be centrifugal design, statically and dynamically balanced.

B. Bearings shall be of heavy-duty construction either ball or roller type for long life operation. Provide grease alemite fittings or extended lube lines to each and all bearings.

C. Fan wheels shall be centrifugal, statically and dynamically balanced. Tip speed, rpm, and motor horsepower shall not exceed listing in manufacturer's catalog for unit specified.

D. Fans shall have integral factory formed base and one piece spun housing without welded seams. Housings shall be provided with wiring channel and shall be of the direct discharge design.

E. Motor shall be one speed, one winding; motor and drive shall be located in a ventilated compartment out of the exhaust air stream. Motors shall be electrically commutated (EC) type with integral potentiometer, for balancing purposes.

F. Each fan shall be equipped with the following accessories: back-draft damper, aluminum bird screen with a minimum of 85% free area, disconnect switch and aluminum prefab roof curb. Disconnect shall be factory installed in the motor compartment and shall be factory wired to the fan motor. Disconnect shall conform to the requirements of Division 26.

2.5 CENTRIFUGAL UP-BLAST ROOF FANS

A. Centrifugal roof fans shall be up-blast direct drive type as indicated on drawings in the Fan Schedule. Ventilator housings shall be of one-piece heavy gauge spun aluminum construction and shall be weatherproof and incorporate an integral weather shield. Ventilators shall be mounted on curbs as described elsewhere in this specification. Fan wheels shall be centrifugal design, statically and dynamically balanced.

B. Wheel shall have the following features: Material type shall be aluminum; Non-overloading, backward inclined centrifugal; Statically and dynamically balanced in accordance to AMCA Standard 204-05; The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.

C. AC Induction Motor shall have the following features: enclosures open drip-proof; permanently lubricated, heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase; Mounted on vibration isolators, out of the airstream; For motor cooling there shall be fresh air drawn into the motor compartment through an area free of discharge contaminants; Accessible for maintenance.

D. Electronically Commutated Motor shall have the following features: enclosures open type; Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors; permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase; Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor; shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal; shall be a minimum of 85% efficient at all speeds.

E. Fan housing shall have the following features: Constructed of heavy gauge aluminum includes exterior housing, curb cap, windband, and motor compartment housing. Galvanized material is not acceptable; Housing shall have a rigid internal support structure. Windband to be one piece uniquely spun aluminum construction and maintain original material thickness throughout the housing; Windband to include an integral rolled bead for strength; Curb cap base to be fully welded to windband to ensure a leak proof construction. Tack welding, bolting, and caulking are not acceptable; Curb cap to have integral deep spun inlet venturi and pre-punched mounting; holes to ensure correct attachment to curb; Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators; Breather tube shall be 10 square inches in size for fresh air motor cooling, and designed to allow wiring to be run through it.

F. Motor cover shall be constructed of aluminum.

G. Vibration isolation shall have the following features: Double studded true isolators; No metal-to-metal contact; Sized to match the weight of each fan.

H. Birdscreen shall be protect fan discharge and be constructed of galvanized steel.

I. Roof Curbs shall have the following features: material shall be Aluminum; insulation shall be 2-inches thick.

2.6 CENTRIFUGAL UTILITY GREASE HOOD EXHAUST FANS

A. Utility vent set specifically manufactured for grease hood exhaust; constructed of heavy gauge steel with backward inclined centrifugal fan, slip joint or flanged inlets, and upblast discharge arrangement. Provide weather-proof motor and drive cover, bottom drain connection, grease collection trough or cup, access door, roof mounting curb with vibration isolated frame, bird screen on discharge, and high temperature/outdoor rated flexible connection on inlet. Grease exhaust fans shall be specifically manufactured for grease exhaust applications, in compliance with NFPA requirements.

B. Concrete gray permatector coating for fan and accessories.

2.7 CENTRIFUGAL UPBLAST GREASE HOOD EXHAUST FANS

A. Centrifugal upblast roof exhauster specifically manufactured for grease hood exhaust; aluminum backward inclined belt drive fan with separated, ventilated motor chamber and vibration isolated motor and drive assembly; spun aluminum venturi housing with removable cover for access; roof curb with curb cap and drainage trough; conduit chase; disconnect switch; Grease exhaust fans shall be specifically manufactured for grease exhaust applications, in compliance with NFPA requirements.

2.8 PLENUM FANS (PARKING DECK)

A. Wheel shall have the following features: statically and dynamically balanced to grade G6.3 per ANSI S2.19; manufactured with a minimum of 12 continuously welded aluminum airfoil blades to move the blade pass frequency into the mid-octave bands; constructed of aluminum to reduce the rotational weight of the wheel and vibration. The wheel shall use 6063-T5 extruded aluminum blades to ensure precision blade tolerances, improve efficiency and reduce vibration; hubs shall be cast of 319 aluminum alloy; Aluminum fan wheels shall not require finish coating; wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.

B. Motor shall have the following features: meet or exceed NEMA Premium efficiencies; NEMA T-frame 900, 12, 18 or 3600 RPM in 60 Hz; Open Drip Proof with a 1.15 service factor.

C. Fan shall have the following features: Plenum fans shall be of the direct drive centrifugal type; Fan plate shall be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.

D. Fan housing shall have the following features: Panels and framework shall be constructed of heavy gauge, precision laser cut and die formed galvanized steel to provide a rigid structure to

support the shaft and bearings and reduce low frequency vibration; shall be provided with minimum 2" insulated enclosure with perforated lining; the entire drive assembly including the inlet cone, wheel and motor assembly shall be isolated from the insulated enclosure with integral neoprene isolators.

2.9 INDUCTION FANS (PARKING DECK)

A. High-velocity jet induction fans shall be: backward-curved centrifugal impellers, using special 3D blade geometry from high-performance composite; driven by full-variable speed EC external rotor motor with integrated EC Controller and integral thermal overload protection; Fans must be configurable to accept direct connection of optional CO, NO2, and temperature sensors; include lockable disconnect switch with three position lockout; housing shall incorporate aerodynamically designed internal flow elements constructed of galvanized steel with a light gray powder-coated finish and incorporate mounting brackets.

PART 3 – EXECUTION

3.1 GENERAL

A. Contractor shall not purchase and/or install fans until Architect/Engineer has reviewed shop drawings/submittals for compliance with engineer design concept.

B. Any fans purchased and/or installed prior to the Architect and Engineer reviews, and found to be in non-compliance shall be removed or corrected as per instructions from Architect/Engineer, at Contractor’s expense.

3.2 INSPECTION

A. General: Examine areas and conditions under which fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Except as otherwise indicated or specified, install fans in accordance with manufacturer's installation instructions and recognized industry practices to insure that fans serve their intended function.

B. Fans shall be installed in complete conformance with the manufacturer's recommendations and the Contract Documents. Coordinate the actual units to be provided with all trades.

C. Isolate each suspended fan and drive from supporting structure by unhoused spring or rubber in shear isolators.

D. Belt-Driven Fans: Mount Motors on slide rails and install matched v-belt sets.

E. Clearance from each fan inlet to nearest obstruction shall equal or exceed manufacturer's minimum recommendations.

F. Adjust fan drives and, where found necessary on the basis of measurements required under Adjustments, Balancing and Tests, replace belts and pulleys in order to deliver scheduled air quantity against actual system resistance.

G. Contractor shall provide and install Arrangement 3, 9 or 10 type centrifugal blowers. Capacities and sizes as scheduled. Fans shall be located as shown on the drawings.

H. Install fans in locations shown on drawings and in accordance with manufacturer's instructions.

I. Connect fans to ductwork only by means of flexible connections.

J. Fans for outdoor mounting to be completely weatherproofed, with a fan motor and drive weather cover.

K. Furnish a spare set of bearings for each fan type and size.

3.4 FIELD QUALITY CONTROL

A. Testing: After installation of fans has been completed, test each fan to demonstrate proper operation of unit at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

B. Start up and check out fans for proper motor phasing, alignment, and vibration-free operation. Improperly aligned fans to be corrected. Change unmatched belts.

C. Test fans in accordance with specification Section 23 05 93, “Testing, Adjusting, and Balancing.”

D. Demonstrate system operation to Owner's maintenance personnel and instruct them in operation requirements.

E. Verify that, where applicable, fans are interlocked as required by control sequence.

3.5 ADJUSTING AND CLEANING

A. The fans shall be tested and adjusted to provide the scheduled capacities.

B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with touch-up paint supplied by the manufacturer.

END OF SECTION 233416

SECTION 233713 - DIFFUSERS, REGISTERS AND GRILLES

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of the work is indicated on the Drawings and schedules and by the requirements of this section.

B. The construction requirements herein shall include appurtenant structures and buildings to which the system is to be installed.

1.2 QUALITY ASSURANCE

A. All grilles, registers and diffusers shall comply with requirements as specified in this section of these specifications.

B. All grilles, registers and diffusers furnished and installed under this section of these specifications shall be new and in first class condition.

C. All grilles, registers and diffusers furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor’s expense.

D. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

E. Firms must be regularly engaged in the manufacture of grilles, registers and diffusers of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

F. Codes and Standards:

1. ARI Compliance: Test and rate grilles, registers and diffusers in accordance with ARI 650 "Standard for Air Outlets and Inlets".
2. ASHRAE Compliance: Test and rate grilles, registers and diffusers in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".

G. NFPA Compliance: Install grilles, register, and diffusers, in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems."

H. Grilles, registers and diffusers shall have a N.C. rating below 35.

1.3 SUBMITTALS

A. Submittal data shall indicate air flow capacities, velocities, pressure drop and noise criteria data for grilles, registers and diffusers.

B. Submit dimensional data including frame styles for each unit provided.

C. Submit installation instructions for each unit provided.

D. Indicate type of finish and provide color chart for Architectural selection of colors as indicated.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in new and in first class condition.

B. Store grilles, registers, and diffusers utilizing suitable means so as to protect from weather, construction work traffic and contamination. Do not store grilles, registers, and diffusers outdoors, Contractor shall cover in a suitable manner to prevent contamination from water, dirt, mud and/or debris. Grilles, registers, and diffusers shall not be laid on grade for storage.

C. Grilles, registers, and diffusers found to be contaminated with water, dirt, mud and/or other debris shall be cleaned and restored to new condition to the satisfaction of the Architect. Contaminated or damaged grilles, registers, and diffusers shall not be used until inspected. Grilles, registers, and diffusers determined to be unsuitable for use by the Architect shall not be used and shall be removed from the job site at the Contractor’s expense.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Model numbers listed as the Basis of Design are by Titus Products, a Division of Philips Industries, Inc. Similar equivalent products by listed manufacturers are acceptable. Subject to compliance with project requirements, provide grilles, registers and diffusers of one of the following manufacturers:

1. Anemostat
2. Krueger Manufacturing Company
3. Metal*Aire, Inc.
4. Nailor Industries
5. Price
6. Titus Products
7. Tuttle & Bailey

B. Grilles, registers and diffusers shall be the products of one manufacturer. Devices shall be tested, rated and certified.

C. The color of all grilles, registers and diffusers shall match the surface in which they are installed, and as selected by the Architect. Additionally, ceiling mounted devices shall be selected to fit in the ceiling in which they are applied.

D. Manufacturer shall provide touch-up materials for field application by the Contractor.

2.2 CEILING MOUNTED SUPPLY AIR DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide ceiling supply air diffusers that have, as a minimum, temperature and velocity traverses, throw and drop data, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling modules with accurate fit and adequate support. Refer to the Architectural drawings and specifications for types of ceiling systems which will contain each type of ceiling supply air diffuser.

D. Types: Provide ceiling diffusers of type, sizes, capacity, and with accessories and finishes as listed on diffuser schedule.

1. Diffuser Faces:
   a. Square: Titus model TMS, square steel diffuser, 3-cone die-stamped louver face, square steel diffuser with 360 degree throw and horizontal/vertical discharge pattern controllers.
   b. Residential: Titus model 250, adjustable, multi-directional steel diffuser with 1-way, 2-way, 3-way, and 4-way patterns.
2. Diffuser Mountings:
   a. Lay-In: Diffuser housing sized to fit between ceiling exposed suspension tee bars and rest on top surface of tee bar.
   b. Surface: Diffuser housing mounted to bottom of duct or in gypsum board ceilings. Provide mounting frames for gypsum board mounted diffusers so that the diffuser rests on the frame but it can be lifted out of the ceiling for access to the ceiling plenum for reading manual damper for balancing.
3. Diffuser Patterns: Four (4) way adjustable discharge pattern, unless noted otherwise in device schedule or on mechanical floorplans.
4. Diffuser Finishes: White baked enamel finish, unless noted otherwise. All finishes and colors shall be coordinated with Architect prior to ordering.

2.3 EXHAUST AND RETURN AIR AND GRILLES

A. Linear slot diffuser; constructed of extruded aluminum; 48" long with two (2) 1" wide slots, insulated plenum for flexible duct connections (10" diameter, unless noted otherwise); full 180-degree adjustment pattern control blades; flanged frame and border for concealed mounting on gypsum board ceiling (no visible screws). Where multiple sections are joined, provide alignment pins or strips. Inactive and Return sections/devices shall be the same as supply sections, but with sound/light trap boot in lieu of supply plenum.

2.4 EXHAUST AND RETURN AIR GRILLES

A. General: Except as otherwise indicated, provide manufacturer's standard wall and duct mounted registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide wall, duct and ceiling mounted registers and grilles that have, as a minimum, temperature and velocity traverses, throw and drop data, and noise criteria ratings for each size device and listed in manufacturer's current data.

C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to the Architectural drawings and specifications for types of wall construction which will contain each type of wall register and grille.

D. Ceiling compatibility: Provide mounting frames for all exhaust grilles in gypsum board ceiling so that the registers and grilled rest on the frame and can be lifted out of the ceiling for access to the ceiling plenum.

E. Types: Provide wall and duct mounted registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule. The following requirements shall apply to nomenclature indicated on schedule:

1. Construction: Standard aluminum frame and grid/blades for return and exhaust, extruded aluminum airfoil blades and steel frames for supply.
2. Eggcrate Device: Titus model 50F, 1/2" x 1/2" x 1/2" grid with border frame. Provide a face operable opposed blade damper for exhaust registers (omit for return grilles). Finish shall be factory applied white baked on white enamel finish as confirmed by Architect. For filtered return grilles, provide filter frame, 2” filter and hinged grille frame.
3. Perforated Device: Titus model PAR, perforated gride with border frame. Finish shall be factory applied white baked on white enamel finish as confirmed by Architect. For filtered return grilles, provide filter frame, 2” filter and hinged grille frame.
4. Opposed Blade Dampers: Adjustable steel opposed blade damper assembly, screw driver operated from face of register.
5. Device Mounting:
    a. Plaster Frame for Surface Mounting. Perimeter frame designed to act as plaster stop and register or grille anchor.
    b. Lay-in Frame for acoustical ceilings.
    c. Concealed type mounting for bar grilles.

PART 3 – EXECUTION

3.1 GENERAL

A. Contractor shall not purchase and/or install grilles, registers and diffusers until Architect/Engineer has reviewed shop drawings / submittals for compliance with engineer design concept.

B. Any grilles, registers and diffusers purchased and/or installed prior to the Architect/Engineer’s review found to be in non-compliance shall be removed or corrected as per instructions from Architect/Engineer at Contractor’s expense.

3.2 INSPECTION

A. Examine areas and conditions under which grilles, registers, and diffuser are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Install grilles, registers, and diffusers in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of grilles, registers and diffusers with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on the Architectural "Reflected

Ceiling Plans" and the Mechanical drawings. Unless otherwise indicated, locate units in center of acoustical ceiling module.

D. Installation shall be neat in appearance and shall be complete with all accessories and trim required to provide a complete and proper installation.

E. Air extractors shall be installed at each supply outlet installed directly on ductwork and at each branch duct takeoff from trunk duct except where splitter damper is indicated on the drawings.

F. Opposed blade volume damper shall be installed in the neck of each supply register and each ceiling and wall exhaust register.

G. Grilles, registers and diffusers shall be installed as indicated and in conformance with the manufacturer's recommendations. Coordinate the actual units to be provided with all trades. Items shall match the ceiling provided to ensure proper installation.

H. Grille, register and diffuser locations shall be coordinated with the Architectural reflected ceiling plans.

I. After installation is complete, Contractor shall touch-up all nicks, scratches, and all marred surfaces with paint to match original color and finish.

3.4 ADJUSTMENT

A. The grilles, registers and diffusers shall be tested and adjusted to provide the scheduled capacities. Refer to specification Section 23 05 93, “Testing, Adjusting and Balancing” for additional information.

END OF SECTION 233713

SECTION 233714 - STATIONARY LOUVERS

PART 1 – GENERAL

1.1 QUALITY ASSURANCE

A. AMCA Standard 500-L Compliance: Provide louvers which have been tested and rated for pressure drops, sound performance, and water penetration with wind-driven rain.

B. All louvers shall be Miami-Dade Approved and Florida Product Approved louvers and must be installed in accordance with the manufacturer installation instructions. Where provided with Motor Operated Dampers or Back Draft Dampers attached, the entire assembly shall be Miami-Dade rated.

1.2 PRODUCT COORDINATION

A. The louvers of one manufacturer (Greenheck) have been used as the basis of design. Any modifications to the mechanical systems and their components, the electrical systems, the building structure and architecture, or any other portion of the building that results from the uses of any product other than the basis of design equipment shall be coordinated with all trades. Such coordination shall occur before delivery of equipment from the manufacturer (before shop drawing submittals) and shall be clearly indicated on the shop drawings. Any modifications shall be performed without incurring any additional cost to the Owner.

1.3 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide louvers from one of the following manufacturers:

1. Greenheck
2. Ruskin
3. Arrow

B. Any units selected must meet or exceed all the requirements of these Contract Documents.

PART 2 – PRODUCTS

2.1 DESCRIPTION

A. Louvers shall be 5" deep, all-welded construction and fabricated from 0.081" nominal wall thickness 6063-T5 extruded aluminum alloy frame with extended sill. Blades shall be drainable type slanted at 37.5 degrees spaced on centers (as scheduled) fabricated of 6063-T5 extruded aluminum with 0.081" wall thickness located on 4-3/4” centers. Louver shall be fitted with an aluminum insect screen. Extended sill shall be provided to capture and drain water to the exterior of the building.

B. Louver shall be wind-driven rain resistant with stationary blades designed to prevent the penetration of wind-driven rain. Provide test data, using the AMCA 500-L wind-driven rain test, with louver submittal.

C. Finish shall be Kynar 500 enamel in a color selected by the Architect. Submit manufacturer's color charts with shop drawings for selection and approval (field painting will not be acceptable).

D. The performance standards shall be certified by the manufacturer in accordance with the AMCA Certified Ratings Program and the louver shall carry the AMCA Seal. Performance standard shall be as follows:

1. Maximum static pressure drop at 500 FPM velocity through free area: 0.08" W.C.
2. Louver shall have a (min.) 99.5% effectiveness ratio for the wind-driven rain test with static (0 fpm) core airflow velocity.
3. Louver shall have a class A penetration rating and a (min.) 99% effectiveness ratio for the wind-driven rain test at the following parameters: 29 mph wind, 3” per hour rainfall rate, 500 fpm core airflow velocity.
4. Nominal free area in relation to gross overall area: 49% at 48”x48”.

E. Greenheck model EHH-600D or approved equivalent.

F. See mechanical drawings for sizes and locations of louvers. Submittals shall include louver data, louver sizes and intended locations. Coordinate exact sizes, locations and colors with Architect prior to ordering.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Louvers shall be installed as indicated and in conformance with the manufacturer's recommendations and architectural details. Coordinate actual installation with all trades.

3.2 INSPECTION

A. General: Examine areas and conditions under which louvers are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

END OF SECTION 233714

SECTION 235123 – GAS VENTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section of the specifications and related drawings describe the requirements pertaining to the gas flues and venting systems for systems including, but not limited to, the following:

1. Domestic water heaters

B. All work specified in this Section is subject to the provisions of Section 23 05 00. See other sections of the project specifications that may apply to components or accessories related to this installation.

C. Extent of work is as indicated in the construction drawings and schedules and by the requirements of this section.

D. The construction requirements herein shall include appurtenant structures and buildings to which the piping system is to be installed.

1.2 QUALITY ASSURANCE

A. All work shall comply with requirements in this section of specifications.

B. All work furnished and installed under this section of these specifications shall be new and in first class condition.

C. All work furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor’s expense.

D. Code Compliance: Provide gas vent installation in accordance with AGA and NFPA requirements. Components shall be UL listed and comply with SMACNA and ASHRAE standards.

E. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

1.3 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in new first-class condition. Rusted, soiled and/or contaminated pipe shall not be permitted for use. Where applicable, materials shall bear markings indicating ASTM specification, grade and other pertinent identification markings, including where manufactured. Unmarked materials shall not be permitted for use.

B. Store flue and vent piping material in racks or other suitable means so as to protect from weather, construction work traffic and contamination. Where material is stored outdoors, Contractor shall cover in a suitable manner to prevent water, dirt, mud and/or debris from entering. Materials shall not be laid on grade for storage.

C. Materials found to be contaminated with water, dirt, mud and/or other debris shall be cleaned and restored to new condition to the satisfaction of the Architect. Contaminated materials shall not be used until inspected.

D. Rusted materials shall not be used and shall be removed from the job site at the Contractor's expense.

1.4 COORDINATION

A. Provide submittal data in accordance with specifications Sections 23 05 00 and 23 05 01.

B. Provide certification of compliance with ASTM and ANSI manufacturing requirements, where applicable.

C. The products of a particular manufacturer has been used as the basis of design in preparation of these documents. Any modifications to the mechanical systems and their components, the electrical systems, the building structure (roof openings, structural supports, etc.), or any other portion of the building that result from the use of any product other than the basis of design equipment shall be coordinated with all other trades. Such coordination shall occur before delivery of products from the manufacturer (i.e. before shop drawing submittals) and shall be clearly indicated on the shop drawings. Any related modifications shall be performed without any additional cost to the Contract.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate the installation of pipe sleeves for floor penetrations and wall penetrations.

1.6 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, provide gas venting materials from one of the following manufacturers:

1. Metal-Fab

2. Selkirk Metalbestos

3. Van Packer

PART 2 - PRODUCTS

2.1 GENERAL

A. The flue supports shall be tested, approved and listed by Underwriter's Laboratories. These supports shall be capable of supporting four times the combined weight of the flue installation.

B. All clearances to combustible material shall be maintained so as to comply with all codes and regulations.

C. Provide weatherproof roof caps. Bird-proof screens on all gas vents.

D. Flues extending above roof surfaces shall terminate in a U.L. listed top or housing assembly, according to Appendix D of NFPA No. 211 or according to local code.

2.2 ATMOSPHERIC NEGATIVE PRESSURE FLUE PIPE

A. Natural draft equipment shall be vested with an approved Type "B" double wall flue piping system. Provide Metalbestos Type QC, or equivalent.

B. Double wall gas vents shall be UL listed for Type "B", consisting of an inner pipe of sheet aluminum, and outer pipe of galvanized sheet steel, with the following minimum thicknesses:

Round Pipe Size	Inner Pipe	Outer Pipe
Up to 6"	0.019"	28 gauge
7" to 18"	0.023"	28 gauge
20" to 24"	0.029"	26 gauge

C. The inner flue pipe shall be aluminum surrounded by a 1/2” air space and galvanized steel outer jacket.

D. Accessories include: Tees, elbows, increasers, draft hood connectors, metal cap with bird barrier, adjustable roof flashing, storm collar, support assembly, thimbles, fire stop spacers, and fasteners. Accessories shall be U.L. listed and fabricated of similar materials as the connection straight sections of vent pipe.

2.3 FLUE PIPE FOR HIGH EFFICIENCY GAS SYSTEMS

A. Flues for high-efficiency atmospheric (88%+) and condensing gas-fired equipment shall be Schedule 40 CPVC with solvent welded joints.

B. Provide drain at low point in to sanitary drain system.

C. Where high-efficiency gas-fired equipment is available with direct combustion air connections, Contractor shall install intake piping per manufacturer recommendations. Provide concentric combustion air and vent flues where indicated in the Contract Documents. Install combination combustion air and vent termination kit at building exterior, as supplied by equipment manufacturer.

2.4 FORCED DRAFT FLUE PIPE

A. Forced-draft equipment shall be vented with a positive pressure piping system, Metalbestos Model PS.

B. The inner flue pipe shall be Type 304 stainless steel surrounded by a 1" air space and an aluminized steel outer jacket.

C. If a welded steel stack is substituted for the Metalbestos Model PS system, increase all flue pipe sized shown on the drawings by four (4") inches.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall not fabricate and/or install gas flues and vent piping until Architect/Engineer has reviewed shop drawings for compliance with engineer design concept.

B. Any systems fabricated and/or installed prior to the Architect/Engineer's review found to be in non-compliance shall be removed or corrected as per instructions from Architect/Engineer at Contractor's expense.

C. Install and test the systems as specified in Sections 23 05 00 and 23 05 93, and in accordance with the specified codes and standards.

D. Adequate fire protection safeguards shall be employed in connection with welding operations.

E. Open ends of flue and vent piping materials shall be plugged during installation to keep dirt and foreign material out of the system.

3.2 EXAMINATION

A. Contractor to examine areas and conditions under which gas flues and vent piping are to be installed and notify Architect in writing of those conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.3 INSTALLATION

A. Gas flues and vent piping shall be installed in complete conformance with manufacturer instructions, local Codes, and the Contract Documents. Where conflicts occur, the more stringent criteria shall govern.

B. Maintain minimum clearances to combustibles as required by Code.

C. Provide all necessary expansion joints, supports, thimbles, etc., for a complete installation.

3.4 SLEEVES

A. Gas flues and vent piping passing through concrete and masonry walls and partitions and through concrete floor shall be provided with sleeves which shall be installed during construction of walls, partitions and floors. All sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors and roof are constructed.

1. Sleeves shall not be installed in structural members of work, except as detailed on structural drawings, or as reviewed by Structural Engineer.

B. Install sleeves accurately centered on runs so that gas flues and vent piping will have free movement in sleeve, including allowance for thermal expansion. Maintain minimum clearances to combustibles as required by Code.

C. Sleeve materials, sizes and lengths shall be as described in specification Sections 23 05 00 and 23 21 00.

3.4 EQUIPMENT CONNECTIONS AND SUPPORTS

A. Gas flue and vent piping connections shall place no strain on the equipment connection. Support vents at intervals recommended by the manufacturer to support the weight of the vent and all accessories.

3.5 FIELD QUALITY CONTROL

A. Testing: After the installation of the equipment has been completed, test each piece of equipment to demonstrate proper operation of equipment at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected.

END OF SECTION 235123

SECTION 237416 – PACKAGED ROOFTOP UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes the design, controls and installation requirements for packaged rooftop air handling units.

B. Furnish and install all required equipment, appurtenances and accessories for a complete installation of the rooftop units.

1.2 RELATED DOCUMENTS

A. Description: All work specified in this Section is subject to the provisions of Section 23 05 00. See other sections of the project specifications that may apply to components or accessories related to this installation.

B. The Mechanical Contractor shall be responsible for all required control and interlock wiring as specified under this section. Wiring shall be color coded and installed in accordance with National Electrical Code and the Electrical Division of these specifications.

C. Work by Others: The Electrical Subcontractor shall install and connect all power wiring.

1.3 QUALITY ASSURANCE

A. Mechanical equipment (including supporting racks, curbs and equipment tie-downs), and the attachment of these elements to one another or to the supporting building structure, shall be designed to resist the wind pressures required by the Florida Building Code, Building; and the Florida Building Code, Mechanical, Section 301.15. design shall be by a Florida licensed professional engineer. the design and inspection of these components shall be by others as they are not part of the primary structural system of the building.

B. Fastening to post-tensioned concrete slabs:

1. The existing structure consists of post-tensioned slab construction. where fasteners to existing concrete slabs are required, installation shall only proceed when one the following requirements are satisfied as necessary to avoid potential damage to the building structure:

a. The penetration depth of the specified fastener is 3/4" or less.

b. The penetration depth of the specified fastener is 3/4" or more, and it has been demonstrated by means of x-ray analysis or another rational scientifically proven method that no conflict occurs between existing tendon locations and the intended placement location of the fastener.

C. All equipment furnished and installed under this section of these specifications shall be new and in first class condition.

D. All units furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor's expense.

E. Codes and Standards:

1. ARI Compliance: Units shall be rated in accordance with AHRI Standards 360.

2. UL Compliance: Units shall be designed in accordance with UL Standard 1995.

3. ETL Compliance: Units shall be ETL tested and certified in accordance with ANSI Z21.47 Standards.

4. NFPA Compliance: Insulation and adhesive shall meet NFPA 90A ratings requirements for flame spread of 25 and smoke developed of 50. Smoke detectors shall be installed in accordance with NFPA.

5. Salt Spray Test Compliance: Casing shall be capable of withstanding 500-hour Federal test method Standard No. 141 (Method 6061) for salt spray resistance.

6. ASHRAE: Unit designed to conform to ASHRAE Standards 90.1 and 15.

7. The system will bear the Energy Star label.

8. The system will be produced in an ISO 9001 approved facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

9. Provide motors and electrical accessories complying with NEMA standards.

10. All wiring shall be in accordance with the National Electric Code (NEC).

F. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

G. Installation, Operation and Maintenance manual with startup requirements shall be provided.

1.4 SUBMITTALS

A. Provide submittals in compliance with specifications Section 23 05 00 and Section 23 05 01.

B. The products of a particular manufacturer has been used as the basis of design in preparation of these documents. Any modifications to the mechanical systems and their components, the electrical systems, the building structure, or any other portion of the building that result from the use of any product other than the basis of design equipment shall be coordinated with all other trades. Such coordination shall occur before delivery of products from the manufacturer (before shop drawing submittals) and shall be clearly indicated on the shop drawings. Any related modifications shall be performed without any additional cost to the Contract. For additional information, refer to equipment schedules on drawings.

1.5 DELIVERY, STORAGE AND HANDLING

A. Unit shall be shipped to prevent damage during transport and thereafter, while in storage awaiting installation.

B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with manufacturer recommendations.

1.6 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with the requirements, rooftop units shall be manufactured by one of the following:

1. York (Johnson Controls, Inc.)
2. Daikin
3. Trane
4. Aaon
5. Carrier

PART 2 – PRODUCTS

2.1 PACKAGED (COOLING ONLY) ROOFTOP UNIT

A. General: Factory assembled, single piece casing and frame, packaged constant air volume electric cooling unit with completed DX refrigeration cooling system, air circulation section, designed for rooftop installations with horizontal discharge air configuration. Contained within the unit enclosure shall be all factory wiring, piping, controls, refrigerant charge, operating oil charge, and special features required prior to field start-up.

B. Provide seacoast protection for equipment.

C. Unit Cabinet

1. Unit cabinet shall be constructed of galvanized steel with hinged neoprene gasketed access panels, 16-gauge load bearing unit base and lifting lugs of openings in the base rails. Cabinet finish shall be bonderized and painted with weather-resistant baked enamel finish complying with ASTM standard B117. Cabinet panels shall be easily removable for access to components for maintenance.

2. Interior surfaces shall be insulated with minimum 1/2” thick, 1 lb. density, fiberglass insulation, neoprene coated on the air side.

D. Fans

1. Evaporator supply fan shall be belt-drive, double inlet type with forward curved blades. Fan shaft shall have permanently lubricated bearings. Fan wheel shall be steel and statically and dynamically balanced.

2. Condenser fans shall be direct-drive propeller type with vertical air discharge through a steel wire guard, statically and dynamically balanced.

E. Coils

1. Evaporator coils shall be leak tested at 150 psig and pressure tested at 300 psig. Condenser coils shall be factory leak tested at 150 psig and pressure tested at 400 psig air pressure. Coils shall have aluminum plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.

F. Refrigeration System

1. Unit shall use fully hermetic scroll compressor for each refrigerant circuit, with oil pump, oil filter screen, oil charging valve, bearing lubrication points, crankcase heater, suction inlet screen, suction and discharge service valves, mounted on spring vibration isolators, filter drier, thermostatic expansion valve, and short cycling protection. Compressors shall have unloading capabilities. Independent refrigerant circuits shall be provided. Refrigerant shall be R-410A.

G. Filter Section

1. Filter section shall consist of factory installed filters of commercially available sizes, 2-inch thick, low velocity, pleated disposable non-woven cotton type with support grid and holding frame, 30% average efficiency per ASHRAE Standard 52-76. Provide sheetmetal blank-offs between edge of filters and unit casing to prevent unfiltered air from passing through to the coil section.

2. Filter face velocity shall not exceed 400 FPM at nominal airflows.

3. Filter section shall use only one size filter.

H. Controls and Safeties

1. Unit Controls shall include:

a. Factory installed micro-processor based control system with complete diagnostics. Unit controls shall respond to temperature and humidity demands, to determine control sequences.

b. Unit shall have a minimum of two (2) stages for cooling.

c. Unit shall be controlled to meet discharge air temperature and humidity setpoints.

2. Safety controls shall include:

a. Automatic reset, motor thermal overload protection.

b. Low oil pressure cutout.

c. Low pressure cutout.

d. Freezestat, evaporator coil.

e. High-pressure cutout.

f. Compressor over-temperature and over-current protection.

g. Anti-cycling time-out period of five (5) minutes.

3. Smoke Detectors: Provide addressable type smoke detectors in the supply ducts of rooftop units with airflows of 2,000 CFM or greater, or capacities of 5-tons or greater. The unit smoke detectors shall shut-down the rooftop unit upon sensing smoke, and shall send a signal to the main fire control panel for the building. Activation of smoke detectors shall activate a supervisory signal with audible and visual alarms.

I. Operating Characteristics:

1. Unit shall be capable of starting and running at 95 degree F ambient outdoor temperature per maximum load criteria of ARI Standard 360.

J. Electrical Requirements:

1. Unit power wiring shall be single point type and enter unit cabinet at one location.

2. Provide disconnect switch factory wired from the switch to the unit.

3. Factory provided and powered convenience outlet with a transformer built into the unit.

K. Motors:

1. Indoor (evaporator and exhaust) fan motor shall be high efficiency type with ball bearings and automatic reset current overload protection manufactured for operation with variable frequency drives.

2. Outdoor (condenser) fan motor shall be totally enclosed type and shall have permanently lubricated bearings, and inherent automatic reset thermal overload protection.

L. Accessories:

1. Thru-the-curb electrical connections shall be provided.

2. 14-inch (unless noted otherwise on schedule) insulated roof curb properly coordinated with roof slope to provide level unit installation. Roof curb and attachment shall meet seismic and wind load requirements.

3. Factory wired convenience receptacle.

4. Refer to the equipment schedules for additional accessories to be provided.

2.2 PACKAGED GAS HEATING / ELECTRIC COOLING ROOFTOP UNIT

A. General: Factory assembled, single piece casing and frame, packaged constant air volume with gas heating and electric cooling unit with completed DX refrigeration cooling system, air circulation section, designed for rooftop installations with vertical/horizontal discharge air configuration (refer to schedule and/or plans for configuration). Contained within the unit enclosure shall be all factory wiring, piping, controls, refrigerant charge, operating oil charge, and special features required prior to field start-up.

B. Provide seacoast protection for equipment.

C. Unit Cabinet

1. Unit cabinet shall be constructed of galvanized steel with hinged neoprene gasketed access panels, 16-gauge load bearing unit base and lifting lugs of openings in the base rails. Cabinet finish shall be bonderized and painted with weather-resistant baked enamel finish complying with ASTM standard B117. Cabinet panels shall be easily removable for access to components for maintenance.

2. Interior surfaces shall be insulated with minimum 1/2” thick, 1 lb. density, fiberglass insulation, neoprene coated on the air side.

D. Fans

1. Evaporator supply fan shall be belt-drive, double inlet type with forward curved blades. Fan shaft shall have permanently lubricated bearings. Fan wheel shall be steel and statically and dynamically balanced.

2. Condenser fans shall be direct-drive propeller type with vertical air discharge through a steel wire guard, statically and dynamically balanced.

E. Coils

1. Evaporator coils shall be leak tested at 150 psig and pressure tested at 300 psig. Condenser coils shall be factory leak tested at 150 psig and pressure tested at 400 psig air pressure. Coils shall have aluminum plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.

F. Refrigeration System

1. Unit shall use fully hermetic scroll compressor for each refrigerant circuit, with oil pump, oil filter screen, oil charging valve, bearing lubrication points, crankcase heater, suction inlet screen, suction and discharge service valves, mounted on spring vibration isolators, filter drier, thermostatic expansion valve, and short cycling protection. Compressors shall have unloading capabilities. Independent refrigerant circuits shall be provided. Refrigerant shall be R-410A.

2. Refrigerant Circuit Operation: Manufacturer to provide modulating hot-gas reheat.

G. Filter Section

1. Filter section shall consist of factory installed filters of commercially available sizes, 2-inch thick, low velocity, pleated disposable non-woven cotton type with support grid and holding frame, 30% average efficiency per ASHRAE Standard 52-76. Provide sheetmetal blank-offs between edge of filters and unit casing to prevent unfiltered air from passing through to the coil section.

2. Filter face velocity shall not exceed 400 FPM at nominal airflows.

3. Filter section shall use only one size filter.

H. Gas Furnace

1. Natural gas heating furnace with the following features:

a. Ductile iron / aluminized-steel heat exchanger.
b. Spark pilot ignition.
c. Induced draft blower.
d. Spark pilot ignition.

I. Economizer

1. Provide outside air economizer kit, including rain hood, with enthalpy control and spring return dampers with adjustable minimum position switch.

J. Controls and Safeties

1. Unit Controls shall include:

a. Factory installed microprocessor based control system with complete diagnostics. Unit controls shall respond to temperature and humidity demands, to determine control sequences.

b. Unit shall have a minimum of two (2) stages for cooling.

c. Unit shall be controlled to meet discharge air temperature and humidity setpoints.

2. Safety controls shall include:

a. Automatic reset, motor thermal overload protection.

b. Low oil pressure cutout.

c. Low pressure cutout.

d. Freezestat, evaporator coil.

e. High-pressure cutout.

f. Compressor over-temperature and over-current protection.

g. Anti-cycling time-out period of five (5) minutes.

3. Smoke Detectors: Provide addressable type smoke detectors in the supply ducts of rooftop units with airflows of 2,000 CFM or greater, or capacities of 5-tons or greater. The unit smoke detectors shall shut-down the rooftop unit upon sensing smoke and shall send a signal to the main fire control panel for the building. Activation of smoke detectors shall activate a supervisory signal with audible and visual alarms.

K. Operating Characteristics:

1. Unit shall be capable of starting and running at 95 degree F ambient outdoor temperature per maximum load criteria of ARI Standard 360.

L. Electrical Requirements:

1. Unit power wiring shall be single point type and enter unit cabinet at one location.

2. Provide disconnect switch factory wired from the switch to the unit.

3. Factory provided and powered convenience outlet with a transformer built into the unit.

M. Motors:

1. Indoor (evaporator and exhaust) fan motor shall be high efficiency type with ball bearings and automatic reset current overload protection manufactured for operation with variable frequency drives.

2. Outdoor (condenser) fan motor shall be totally enclosed type and shall have permanently lubricated bearings, and inherent automatic reset thermal overload protection.

N. Accessories:

1. Thru-the-curb electrical connections shall be provided.

2. 14-inch (unless noted otherwise on schedule) insulated roof curb properly coordinated with roof slope to provide level unit installation. Roof curb and attachment shall meet seismic and wind load requirements.

3. Factory wired convenience receptacle.

4. Refer to the equipment schedules for additional accessories to be provided.

5. Provide modulating hot-gas reheat.

2.3 PACKAGED ELECTRIC HEATING / ELECTRIC COOLING VAV ROOFTOP UNIT

A. General: Factory assembled, single piece casing and frame, packaged constant air volume electric cooling unit with completed DX refrigeration cooling system, air circulation section, designed for rooftop installations with vertical discharge air configuration. Contained within the unit enclosure shall be all factory wiring, piping, controls, refrigerant charge, operating oil charge, and special features required prior to field start-up.

B. Provide seacoast protection for equipment.

C. Unit Cabinet

1. Unit cabinet shall be constructed of galvanized steel with hinged neoprene gasketed access panels, 16 gauge load bearing unit base and lifting lugs of openings in the base rails. Cabinet finish shall be bonderized and painted with weather-resistant baked enamel finish complying with ASTM standard B117. Cabinet panels shall be easily removable for access to components for maintenance.

2. Interior surfaces shall be insulated with minimum 1/2” thick, 1 lb. density, fiberglass insulation, neoprene coated on the air side.

D. Fans

1. Evaporator supply fan shall be belt-drive, double inlet type with forward curved blades. Fan shaft shall have permanently lubricated bearings. Fan wheel shall be steel and statically and dynamically balanced.

2. Condenser fans shall be direct-drive propeller type with vertical air discharge through a steel wire guard, statically and dynamically balanced.

E. Coils

1. Evaporator coils shall be leak tested at 150 psig and pressure tested at 300 psig. Condenser coils shall be factory leak tested at 150 psig and pressure tested at 400 psig air pressure. Coils shall have aluminum plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.

F. Refrigeration System

1. Unit shall use fully hermetic scroll compressor for each refrigerant circuit, with oil pump, oil filter screen, oil charging valve, bearing lubrication points, crankcase heater, suction inlet screen, suction and discharge service valves, mounted on spring vibration isolators, filter drier, thermostatic expansion valve, and short cycling protection. Compressors shall have unloading capabilities. Independent refrigerant circuits shall be provided. Refrigerant shall be R-410A.

2. Refrigerant Circuit Operation: Manufacturer to provide modulating hot-gas reheat.

G. Filter Section

1. Filter section shall consist of factory installed filters of commercially available sizes, 2-inch thick, low velocity, pleated disposable non-woven cotton type with support grid and holding frame, 30% average efficiency per ASHRAE Standard 52-76. Provide sheetmetal blank-offs between edge of filters and unit casing to prevent unfiltered air from passing through to the coil section.

2. Filter face velocity shall not exceed 400 FPM at nominal airflows.

3. Filter section shall use only one size filter.

H. Electric Heat

1. Electric resistance heating coil

a. Nichrome open wire heating element with ceramic bushings.
b. UL listed with limit controls and thermal cut-out safety fuses.

I. Economizer

1. Provide outside air economizer kit, including rain hood, with enthalpy control and spring return dampers with adjustable minimum position switch.

J. Controls and Safeties

1. Unit Controls shall include:

a. Factory installed microprocessor based control system with complete diagnostics. Unit controls shall respond to temperature and humidity demands, to determine control sequences.

b. Unit shall have a minimum of two (2) stages for cooling.

c. Unit shall be controlled to meet discharge air temperature and humidity setpoints.

2. Safety controls shall include:

a. Automatic reset, motor thermal overload protection.

b. Low oil pressure cutout.

c. Low pressure cutout.

d. Freezestat, evaporator coil.

e. High-pressure cutout.

f. Compressor over-temperature and over-current protection.

g. Anti-cycling time-out period of five (5) minutes.

3. Smoke Detectors: Provide addressable type smoke detectors in the supply ducts of rooftop units with airflows of 2,000 CFM or greater, or capacities of 5-tons or greater. The unit smoke detectors shall shut-down the rooftop unit upon sensing smoke, and shall send a signal to the main fire control panel for the building. Activation of smoke detectors shall activate a supervisory signal with audible and visual alarms.

K. Operating Characteristics:

1. Unit shall be capable of starting and running at 95 degree F ambient outdoor temperature per maximum load criteria of ARI Standard 360.

L. Electrical Requirements:

1. Unit power wiring shall be single point type and enter unit cabinet at one location.

2. Provide disconnect switch factory wired from the switch to the unit.

3. Factory provided and powered convenience outlet with a transformer built into the unit.

M. Motors:

1. Indoor (evaporator and exhaust) fan motor shall be high efficiency type with ball bearings and automatic reset current overload protection manufactured for operation with variable frequency drives.

2. Outdoor (condenser) fan motor shall be totally enclosed type and shall have permanently lubricated bearings, and inherent automatic reset thermal overload protection.

3. The evaporator fan motor shall be a totally enclosed electrically commutated motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency and mounted on rubber isolators.

4. Variable frequency drives shall be factory wired and mounted in the unit.

N. Accessories:

1. Thru-the-curb electrical connections shall be provided.

2. 14-inch (unless noted otherwise on schedule) insulated roof curb properly coordinated with roof slope to provide level unit installation. Roof curb and attachment shall meet seismic and wind load requirements.

3. Factory wired convenience receptacle.

4. Refer to the equipment schedules for additional accessories to be provided.

5. Provide modulating hot-gas reheat.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall not purchase and/or install equipment until Architect/Engineer has reviewed shop drawings/submittals for compliance with engineer design concept.

B. Any equipment purchased and/or installed prior to the Architect and Engineer reviews, and found to be in non-compliance shall be removed or corrected as per instructions from Architect/Engineer, at Contractor’s expense.

3.2 EXAMINATION

A. Contractor to examine areas and conditions under which rooftop units are to be installed and notify Architect in writing of those conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.3 INSTALLATION

A. General: Install packaged rooftop air handling units in accordance with manufacturer's installation instructions, in accordance with State and local Code requirements, and the Contract Documents.

B. Install units in locations shown on drawings. Provide proper clearances as required for all components. Coordinate carefully all nearby building structural components, etc. Clearance from each unit inlet to nearest obstruction shall equal or exceed manufacturer's minimum recommendations.

C. Provide flexible connections at ductwork connections.

D. Coordinate all work with other trades as necessary for proper interfacing.

E. All equipment shall be protected from any form of damage. Any damaged equipment shall be replaced without additional cost.

F. Equipment intended for outdoor installation shall be completely weatherproofed.

G. Provide installation, operation and maintenance manual to the Owner.

3.4 FIELD QUALITY CONTROL

A. Testing: After installation of equipment has been completed, test unit to demonstrate proper operation at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

B. Start-up: The initial start-up shall be made by an authorized representative of the equipment manufacturer. Check fans for proper motor phasing, alignment, and vibration-free operation. Improperly aligned fans to be corrected. Change unmatched belts.

C. Test equipment in accordance with specification Section 23 05 93, “Testing, Adjusting, and Balancing.” The units shall be tested and adjusted to provide the scheduled capacities. All controls shall be tested and adjusted.

D. Training: The contractor shall provide manual describing all operating and routine maintenance service procedures to be used with the temperature controls. Contractor shall instruct the Owner's designated representatives in system/unit/controls operation and maintenance procedures. The duration of the instruction period shall be to the satisfaction of the Owner/Operator.

E. Verify that units are controlled as required.

F. Warranty: All construction, installation and control devices shall be warranted to be free from defects in workmanship and material for a period of one (1) year from the date of job acceptance by the Owner. Compressors shall carry an additional four (4) year “parts only” warranty. Any equipment or labor found to be defective during this period shall be repaired or replaced without expense to the Owner.

END OF SECTION 237416

SECTION 23 74 33 – DEDICATED OUTDOOR AIR UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Description: All work specified in this Section is subject to the provisions of Section 23 05 00. See other sections of the project specifications that may apply to components or accessories related to this installation.

B. The Mechanical Contractor shall be responsible for all required control and interlock wiring as specified under this section. Wiring shall be color coded and installed in accordance with National Electrical Code and the Electrical Division of these specifications.

C. Work by Others: The Electrical Subcontractor shall install and connect all power wiring.

1.2 DESCRIPTION

A. This section includes the design, controls and installation requirements for packaged 100% dedicated outdoor-air units.

B. Units must be specifically designed for outdoor installation.

C. Furnish and install all required equipment, appurtenances and accessories for a complete dedicated outdoor-air system, constructed in a horizontal configuration.

1.3 QUALITY ASSURANCE

A. Mechanical equipment (including supporting racks, curbs and equipment tie-downs), and the attachment of these elements to one another or to the supporting building structure, shall be designed to resist the wind pressures required by the Florida Building Code, Building; and the Florida Building Code, Mechanical, Section 301.15. design shall be by a Florida licensed professional engineer. the design and inspection of these components shall be by others as they are not part of the primary structural system of the building.

B. Fastening to post-tensioned concrete slabs:

1. The existing structure consists of post-tensioned slab construction. where fasteners to existing concrete slabs are required, installation shall only proceed when one the following requirements are satisfied as necessary to avoid potential damage to the building structure:

a. The penetration depth of the specified fastener is 3/4" or less.

b. The penetration depth of the specified fastener is 3/4" or more, and it has been demonstrated by means of x-ray analysis or another rational scientifically proven method that no conflict occurs between existing tendon locations and the intended placement location of the fastener.

C. All equipment furnished and installed under this section of these specifications shall be new and in first class condition.

D. All units furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor's expense.

E. Codes and Standards:

1. Provide unit which has been tested and rated for air and sound performance in accordance with AMCA standards, and bear AMCA Certified Rating Seal. AMCA certification of individual components is not acceptable.

2. Provide unit which is designed, manufactured, and tested in accordance with Underwriters Laboratories (UL).

3. Unit Energy Efficiency Ratio (EER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

4. Unit shall be ETL certified per UL 1995, and bear an ETL sticker.

5. Provide motors and electrical accessories complying with NEMA standards.

F. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

1.4 SUBMITTALS

A. Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, material types and gauges, filter information, factory supplied accessories, electrical characteristics and connection requirements. Also include the following unit efficiency information:

1. Complete fan performance curve for supply air.

2. Performance data for both summer and winter operation, using ASHRAE published outdoor air information (99.6% / 0.4%) at project location, unless noted otherwise in Contract Documents.

3. Combined efficiency data per ARI Guideline V-2003 for each model. Data shall include RER, COP, Unitary Net Cooling, Unitary EER and CEF.

B. Installation, Operation and Maintenance manual with startup requirements shall be provided.

C. Shop Drawings: Unit drawings shall be provided to indicate assembly, unit dimensions, construction details, clearances, and connection details. Computer generated fan curves for fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

1.5 DELIVERY, STORAGE AND HANDLING

A. Unit shall be shipped with doors bolted shut to prevent damage during transport and thereafter, while in storage awaiting installation.

B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation and Maintenance manual.

1.6 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, provide package rooftop dedicated outdoor-air units from one of the following manufacturers:

1. Daikin

2. Greenheck

3. Aaon

4. Addison

PART 2 - PRODUCTS

2.1 COORDINATION

A. The products of a particular manufacturer has been used as the basis of design in preparation of these documents. Any modifications to the mechanical systems and their components, the electrical systems, the building structure, or any other portion of the building that result from the use of any product other than the basis of design equipment shall be coordinated with all other trades. Such coordination shall occur before delivery of products from the manufacturer (before shop drawing submittals) and shall be clearly indicated on the shop drawings. Any related modifications shall be performed without any additional cost to the Contract. For additional information, refer to equipment schedules on drawings.

2.2 GENERAL

A. Packaged rooftop unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet that shall include but not limited to: compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, hot-gas reheat, modulating gas heat and unit controls.

B. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit prior to shipment. Run test report shall be supplied with the unit in the service compartment’s literature pocket.

C. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.

D. Unit components shall be labeled, including refrigeration system components and electrical and controls components.

E. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.

F. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.

G. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

H. Unit complete shall be ETL listed.

I. Unit to be shipped fully charged with R410A.

J. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.

K. Submittals must demonstrate that scheduled unit leaving air temperature (LAT) is met, that fan and motor heat temperature rise has been considered and scheduled entering air temperature (EAT). Draw-thru cooling - Scheduled EAT equals cooling coil EAT and scheduled unit LAT equals cooling coil LAT plus temperature rise.

L. Provide seacoast protection for equipment.

2.3 UNIT CASING AND FRAME

A. Unit shall be of internal frame type construction of G90 galvanized steel. All panels shall be insulated, double-wall construction with thermal break. Panels exposed to the weather shall be a minimum of 18-gauge galvanized steel (motor supports shall be a min. 14-gauge galvanized steel). Where top panels are joined there shall be a standing seam to insure positive weather protection. All exterior metal-to-metal seams shall be sealed with closed cell neoprene gasketing, requiring no caulking at job site. Unit base to be designed for curb mounting. Unit base shall over hang the curb. Curb is to be recessed under the unit for a positive seal against water run-off. All components shall be easily accessible through large removable access panel for supply compartment. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance.

B. Foam Insulation shall provide a minimum thermal resistance R-value of 13.0.

C. Unit construction shall be designed to operate at total static pressures up to 8.0 inches w.g.

D. Provide quality unit construction with performance tested in accordance with ASHRAE Std 111 – cabinet air leakage shall not exceed leak class 6 (CL = 6), at +/- 6 in. w.c. casing pressure, where maximum cabinet leakage (cfm/100 square foot of casing surface area) = CL x P^0.65. Provide quality unit construction with air leakage less than 0.5% of design airflow up to 5 in. w.c.. Provide quality unit construction with air leakage less than 1.0% of design airflow up to 8 in. w.c..

E. Exterior surfaces shall be constructed of pre-painted galvanized steel for aesthetics and long-term durability. Paint finish to include a base primer with a high quality, polyester resin topcoat of a neutral beige color. Finished surface to withstand a minimum 1000-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.

F. The unit base frame shall be constructed of 13-gauge pre-painted steel to prevent base rail corrosion.

G. Access shall be provided in each critical individual section in order to provide access to components such as: fan section(s), filter sections(s), electrical components, control components, motorized damper section, cooling coil, and heating vestibule section. Access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.

H. Cabinet shall have factory installed duct flanges at all duct openings.

I. Roof-mounted unit shall be waterproof design so that water cannot enter the building through the fan housing, whether or not the fan is operating.

J. Unit casing shall be constructed to withstand suction pressure of 3.0” w.g.

K. Unit shall be provided with horizontal discharge. Vertical units with a horizontal curb adapters are not allowed.

2.4 OUTDOOR AIR SECTION

A. Weather hoods shall be constructed of galvanized steel finished with the same durable finish as the main unit. Unit shall be provided with a Metal Mesh pre-filter in the outdoor air hood/section to prefilter large particulate to prevent early filter clogging. Outdoor air hood shall incorporate a moisture eliminator filters to drain water away from the entering air stream. Moisture eliminator shall be of aluminum, consisting of corrugated mesh to eliminate water penetration into unit.

B. Unit shall be provided with a 100% Outside Air damper. The outside air damper shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1” differential pressure in according with testing defined in AMCA 500. Control of the dampers shall be by a factory installed direct coupled actuator

2.5 INSULATION

A. Cabinet shall be insulated with 1” thick fiberglass insulation. Insulation shall comply with NFPA 90 and erosion requirements of UL 181, with the following criteria:

1. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.

2. Insulation shall be of semi-rigid type and installed between inner and outer shells of all cabinet exterior components.

2.6 BLOWER SECTIONS

A. All Fans shall be statically and dynamically balanced for continuous operation at maximum rated fan speed and horsepower as an assembly in planes as per DIN / ISO 21940 to balancing grade G 6.3 or better or provide 2” Spring isolation for each fan.

B. All fans shall be provided with totally enclosed maintenance-free ball bearings and permanent lubrication. Bearings shall be selected for a minimum life in excess of 350,000 hrs (L50) at selected operating point and external lubrication points.

C. Supply Fan(s)

1. All fans shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance

2. The fan motor shall be a totally enclosed electrically commutated motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency and mounted on rubber isolators.

3. Variable frequency drives shall be factory wired and mounted in the unit.

D. Blower performance shall be factory tested.

E. Fans shall be scheduled on plans indicating manufacturer's name and model number, CFM, static pressure, sones, drive, horsepower and voltage. Fan motors shall be not less than brake horsepower required at scheduled capacity plus ten percent (10%).

2.7 COOLING COILS

A. Evaporator Coils

1. Coils shall be designed for use with R-410A refrigerant.

2. Direct expansion (DX) cooling coils shall be fabricated of seamless 1/2" diameter high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins mechanically bonded to the tubes and galvanized steel end casings. Coils shall be a multi-row, staggered tube design with a minimum of 4 rows. All units shall have two independent refrigerant circuits and shall use an interlaced coil circuiting that keeps the full coil face active at all load conditions.

3. Each refrigeration circuit shall be equipped with a thermostatic expansion valve for control refrigerant flow control.

4. The refrigerant suction lines shall be fully insulated from the expansion valves to the compressors

5. The distributor tubes shall be sleeved or coated to provide longevity and protection from leaks.

6. All coils shall be factory hydrogen or helium leak tested.

7. The drain pan shall be stainless steel and designed to comply with ASHRAE- 62.1 double sloped requirements drain pan shall be provided with the cooling coil. The drain pan shall extend beyond the leaving side of the coil and underneath the cooling coil connections. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall be connected to a threaded drain connection extending through the unit base. Units with stacked cooling coils shall be provided with a secondary drain pan piped to the primary drain pan.

8. Insulation under the drain pan should be a closed cell structure to prevent moisture from wicking under the drain pan. Fiberglass is NOT allowed.

2.8 REFRIGERATION SYSTEMS

A. Unit shall be factory charged with R-410A refrigerant.

B. Compressors shall be scroll type with thermal overload protection and carry a 5-year non-prorated warranty, from the date of original equipment shipment from the factory.

C. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.

D. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.

E. Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control.

F. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low- pressure sides and a factory installed replaceable core liquid line filter driers.

G. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.

H. Lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.

I. Each refrigeration circuit shall be equipped with a liquid line sight glass, gauge ports, crankcase heater, anti-slug protection, motor overload protection and time delay to prevent short cycling and simultaneous starting of compressors following a power failure

J. Unit shall be provided with an adjustable compressor lockout

K. Provide head pressure control.

L. Each unit shall have two independent refrigeration circuits for redundancy. Each circuit shall be complete with a low-pressure control, filter-drier, liquid moisture indicator/sight-glass, thermal expansion valve, and a manual reset high pressure safety switch. The thermal expansion valve shall be capable of modulation from 100% to 25% of its rated capacity. Sight-glasses shall be accessible for viewing without disrupting unit operation. Each circuit shall be dehydrated and factory charged with Refrigerant 410A and oil.

M. Each unit shall have at least 4 compressor stages of cooling capacity control for better part load control as required by ASHRAE 90.1-2013.

2.9 AIR COOLED CONDENSERS

A. All units shall provide the Energy Efficiency specified EER and IEER per the scheduled equipment or higher.

B. Condenser fans shall be a vertical discharge, axial flow, direct drive fans. Fan blades shall be constructed of steel and riveted to a steel center hub. Condenser fan motors shall be heavy-duty, inherently protected, three-phase, non-reversing type with permanently lubricated ball bearing and integral rain shield.

C. Condenser fans shall be high efficiency electrically commutated motor driven with factory installed head pressure control module. Condenser airflow shall continuously modulate based on head pressure and cooling operation shall be allowed down to 35°F with adjustable compressor lockout

D. Condenser fans shall be VFD driven variable speed for condenser head pressure control. Factory provided and factory programmed VFDs shall continuously modulate the fan air flow to maintain head pressure at acceptable levels. Cooling operation shall be allowed down to 35°F with adjustable compressor lockout

E. Coils shall be designed for use with R-410A refrigerant. Coils shall be all aluminum design, and mounted on polymer brackets, to minimize di-electric corrosion. The coils shall be multi-pass and fabricated from aluminum microchannel tube design with high efficiency aluminum fins. Fins shall be brazed to the tubing for a direct bond. Each condenser coil shall be factory hydrogen or helium leak tested.

F. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.

G. Coils shall be protected from incidental contact to coil fins by a coil guard. Coil guard shall be constructed of cross wire welded steel with PVC coating

2.10 NATURAL GAS HEATING

A. Stainless steel heat exchanger furnace shall carry a 15-year non-prorated warranty, from the date of original equipment shipment from the factory.

B. Gas furnace shall consist of stainless steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established. Aluminized steel heat exchangers are NOT acceptable.

1. The heat exchanger design shall collect condensate in a collection point and have a condensate drain.

2. Heat trace shall be included on the condensate drain.

C. Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.

D. Unit shall include a single gas connection and have gas supply piping entrances in the unit base for through-the-curb gas piping and in the outside cabinet wall for across the roof gas piping.

E. High Turndown Modulating Natural Gas Furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls compartment. Gas heater shall be capable of capacity turndown ratio as shown on the unit rating sheet.

F. Auxiliary gas heating capacity shall be sized to meet heating leaving air temperature setpoint when heat pump heating is in operation. Auxiliary heating capacity shall be available for operation when heat pump heating is in operation.

G. The burner shall be specifically designed to burn natural gas and shall include a micro-processor based flame safeguard control, combustion air proving switch, pre-purge timer and spark ignition. Status and alarm codes are available at the unit controller via a network connection and are available for BAS integration.

2.11 CONTROLS

A. Factory Installed and Factory Provided Controller.

B. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of stand-alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

C. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.

D. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.

E. Makeup Air Controller

1. Unit shall modulate cooling with constant airflow to meet ventilation outside air loads. Cooling capacity shall modulate based on supply air temperature.

2. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet outside air humidity loads and prevent supply air temperature swings and overcooling of the space.

3. Dehumidification operation with Hot gas reheat shall use direct air temperature feedback from the leaving face of the evaporator coil for controlling the compressor cooling capacity and the reheat will be fully modulate to maintain the leaving/supply air temperature set point. The leaving/supply air temperature set point can be reset based on outside and space temperature or humidity.

F. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a LonWorks or BACnet network.

2.12 ELECTRICAL

A. All electrical components shall be UL listed, approved or classified where applicable and wired in compliance with the National Electrical Code. Weather proof disconnect switch and motor starters shall be supplied as standard components. Control box shall include motor starters,

control circuit fusing, control transformer for 24 VAC circuit and safety disconnect. Motor starters shall consist of a contactors and adjustable overload protection and shall be provided for all motors in the unit.

B. Unit shall be provided with remote stop/start terminals (smoke Detector interface) which require contact closure for unit operation. When these contacts are open the low voltage circuit is broken and the unit will not operate.

C. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with unit shall be number and color coded and labeled according to the electrical diagram provided for easy identification.

D. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch circuit short circuit protection, 115 volt control circuit transformer and fuse, system switches, and a high temperature sensor. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the of the main control panels for field wiring entrance.

E. All 115-600 volt internal and external wiring between control boxes and components shall be protected from damage by dedicated electrical raceways.

F. The receptacle shall be powered by a field supplied 115V source.

G. Single non-fused disconnect switch shall be provided for connecting electrical power at the unit. Disconnect switches shall be mounted internal to the control panel and operated by an externally mounted handle.

H. Unit SCCR Rating to be 65 kA minimum.

I. Unit shall be provided with phase, voltage and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage or on phase reversal.

J. Unit shall be provided with a safety shutdown terminal for installation of field emergency input.

K. All electrical options shall have a +/- 10 percent voltage utilization range to protect against voltage variation.

2.13 FILTERS

A. Unit shall include 4-inch thick, pleated panel filters with an ASHRAE MERV rating of 8, upstream of the cooling coil.

B. All units shall be provided with clogged filter switches and alarm enunciation.

2.14 ROOF CURBS

A. Provide roof curb with vibration isolation. Curbs shall to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb gasket shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting of the rooftop unit. Built-up or curb adapters

for side discharge and/or intake are NOT allowed. Coordinate with Architect and Structural Engineer.

2.15 ACOUSTICS

A. Equipment sound performance shall meet the scheduled discharge sound power.

B. Discharge Plenum sections shall be lined with a perforated acoustic liner to enhance sound attenuation.

C. Discharge Plenum sections shall be lined with a perforated acoustic liner to enhance sound attenuation.

PART 3 – EXECUTION

3.1 GENERAL

A. Contractor shall not purchase and/or install equipment until Architect/Engineer has reviewed shop drawings/submittals for compliance with engineer design concept.

B. Any equipment purchased and/or installed prior to the Architect and Engineer reviews, and found to be in non-compliance shall be removed or corrected as per instructions from Architect/Engineer, at Contractor’s expense.

3.2 EXAMINATION

A. Contractor to examine areas and conditions under which dedicated outdoor-air units are to be installed and notify Architect in writing of those conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.3 INSTALLATION

A. General: Install dedicated outdoor-air equipment in accordance with manufacturer's installation instructions, in accordance with State and local Code requirements, and the Contract Documents.

B. Install units in locations shown on drawings and in accordance with manufacturer's instructions.

C. Provide proper clearances as required for all components. Coordinate carefully all nearby building structural components, etc. Clearance from each unit inlet to nearest obstruction shall equal or exceed manufacturer's minimum recommendations. Clearance between outdoor air intake and any facility exhaust opening or vent shall be 10 feet (minimum).

D. Provide flexible connections at ductwork connections.

E. Coordinate all work with other trades as necessary for proper interfacing.

F. All equipment shall be protected from any form of damage. Any damaged equipment shall be replaced without additional cost.

G. Equipment intended for outdoor installation shall be completely weatherproofed.

H. Provide installation, operation and maintenance manual to the Owner.

I. Furnish a spare set of bearings for each fan type and size.

3.4 FIELD QUALITY CONTROL

A. Testing: After installation of equipment has been completed, test unit to demonstrate proper operation at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

B. Start-up: The initial start-up shall be made by an authorized representative of the equipment manufacturer. Check fans for proper motor phasing, alignment, and vibration-free operation. Improperly aligned fans to be corrected. Change unmatched belts.

C. Test equipment in accordance with specification Section 23 05 93, “Testing, Adjusting, and Balancing.” The units shall be tested and adjusted to provide the scheduled capacities. All controls shall be tested and adjusted.

D. Demonstrate system operation to Owner's maintenance personnel and instruct them in operation and maintenance requirements.

E. Verify that units are interlocked as required.

END OF SECTION 237433

SECTION 23 81 23 – SPLIT SYSTEM AIR CONDITIONERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes the design, controls and installation requirements for split system air conditioners. Furnish and install all required equipment, appurtenances and accessories for a complete installation.

1.2 RELATED DOCUMENTS

A. Description: All work specified in this Section is subject to the provisions of Section 23 05 00. See other sections of the project specifications that may apply to components or accessories related to this installation.

B. The Mechanical Contractor shall be responsible for all required control and interlock wiring as specified under this section. Wiring shall be color coded and installed in accordance with National Electrical Code and the Electrical Division of these specifications.

C. Work by Others: The Electrical Subcontractor shall install and connect all power wiring.

1.3 QUALITY ASSURANCE

A. Mechanical equipment (including supporting racks, curbs and equipment tie-downs), and the attachment of these elements to one another or to the supporting building structure, shall be designed to resist the wind pressures required by the Florida Building Code, Building; and the Florida Building Code, Mechanical, Section 301.15. design shall be by a Florida licensed professional engineer. the design and inspection of these components shall be by others as they are not part of the primary structural system of the building.

B. Fastening to post-tensioned concrete slabs:

1. The existing structure consists of post-tensioned slab construction. where fasteners to existing concrete slabs are required, installation shall only proceed when one the following requirements are satisfied as necessary to avoid potential damage to the building structure:

a. The penetration depth of the specified fastener is 3/4" or less.
b. The penetration depth of the specified fastener is 3/4" or more, and it has been demonstrated by means of x-ray analysis or another rational scientifically proven method that no conflict occurs between existing tendon locations and the intended placement location of the fastener.

C. All equipment furnished and installed under this section of these specifications shall be new and in first class condition.

D. All systems furnished and/or installed by Contractor found to be in non-compliance with these specifications shall be removed and replaced with materials complying with this section of these specifications at Contractor’s expense.

E. Codes and Standards:

1. AHRI Compliance: Units shall be rated in accordance with AHRI Standard 240 and listed in the latest AHRI directory.
2. UL Compliance: Units shall be designed in accordance with UL standards.
3. NFPA Compliance: Insulation and adhesive shall meet NFPA 90A ratings requirements for flame spread of 25 and smoke developed of 50. Smoke detectors shall be installed in accordance with NFPA.
4. Salt Spray Test Compliance: Casing shall be capable of withstanding 500-hour Federal test method Standard No. 141 (Method 6061) for salt spray resistance.
5. ASHRAE: System designs shall conform to ASHRAE Standards 90.1 and 15.
6. The system will bear the Energy Star label.
7. The system will be produced in an ISO 9001 approved facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
8. Provide motors and electrical accessories complying with NEMA standards.
9. All wiring shall be in accordance with the National Electric Code (NEC).

F. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

G. Installation, Operation and Maintenance manual with startup requirements shall be provided.

1.4 SUBMITTALS

A. Provide submittals in compliance with specifications Section 23 05 00 and Section 23 05 01.

B. The products of a particular manufacturer has been used as the basis of design in preparation of these documents. Any modifications to the mechanical systems and their components, the electrical systems, the building structure, or any other portion of the building that result from the use of any product other than the basis of design equipment shall be coordinated with all other trades. Such coordination shall occur before delivery of products from the manufacturer (before shop drawing submittals) and shall be clearly indicated on the shop drawings. Any related modifications shall be performed without any additional cost to the Contract. For additional information, refer to equipment schedules on drawings.

1.5 DELIVERY, STORAGE AND HANDLING

A. Unit shall be shipped to prevent damage during transport and thereafter, while in storage awaiting installation.

B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with manufacturer recommendations.

D. The outdoor unit shall be factory charged with R-410A.

1.6 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, provide split systems from one of the following manufacturers:
   1. Daikin
   2. Carrier
   3. Trane
   4. York (Johnson Controls, Inc.)

B. All split systems shall be of the same manufacturer. Material and equipment furnished under this specification shall be standard catalogued products of manufacturers who have produced that equipment for at least five (5) years.

PART 2 – PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONERS

A. General: The split system shall be fully functional, providing cooling and heating in the capacities scheduled. The system shall consist of: indoor DX heat pump unit (HP), outdoor air-cooled condensing unit (CU), electric strip heat, refrigerant line sets, condensate drainage, condensate pump, controls and electrical service, as described below.
   1. Manual and automatic controls, factory wired, and accessible for service and inspection, shall be provided. Controls shall include head pressure control, solenoid-operated switchover valve, thermostatic expansion valve, reversing valve, and indoor temperature control.
   2. System shall be rated for and capable of operating with long refrigerant line lengths, at rated capacities, with no reduction in equipment or component life.
   3. Provide complete air-side economizers at heat pump units (HP), and interlock with condensing unit (CU) compressors, where indicated in Contract Documents.

B. Heat Pump Unit (HP): shall be a self-contained electrically operated unit with DX cooling, reverse cycle heating, electric strip heat and filter rack. Provide 1” thick filters with a minimum 30% efficiency. Units shall be provided with drain connection and integral pump (powered by Heat Pump Unit) for condensate drainage. Provide all necessary, piping, control circuits, and accessories required for a complete operating unit ready for operation after being set in place and connected to the associated refrigerant piping, drain, duct system, and utilities.
   1. Cabinet shall be heavy gauge steel, bonderized inside and out, with 3/4” thick, 1-1/2 lb. internal liner rated at R-4.2, with vapor barrier. Access panels shall be provided for access to all parts requiring service.
   2. Coil shall be of aluminum fin/copper tube construction, specifically manufactured for refrigerant use with thermostatic expansion valve (TXV).
   3. Fans shall be of the centrifugal forward curved type, quiet in operation and adequately secured to shafts. Bearings shall be permanently lubricated sealed type. Fan shall be direct driven with ECM fan motor. All fans shall be dynamically and statically balanced. Supply air fans shall be centrifugal type capable of supplying the airflow and static pressure specified. Fan ratings shall conform to AMCA 210.

4. Electric duct heaters shall be nichrome open wire heating element with ceramic bushings, with fused power supply, automatically resetting limit switches and heat limiters for thermal protection. Heaters shall be UL listed. Electric duct heaters are supplemental and are not integral to the heat pump. Refer to Section 238239 Electric Heater for more information.
5. Heat pump unit (HP) and electric duct heater shall have separate electrical connections, unless noted otherwise in Contract Documents.
6. CONDENSATE PUMP (at the Contractor's option): Vertical type condensate pumping unit with high impact polymer base tank, stainless steel shaft, safety switch, thermal overload protection, check valve, 1/30 HP motor, 120V/1ph 1.5A, to pump 25 GPH at 15 ft. of head, Little Giant model VCM-20ULS or approved equivalent. For return air ceiling plenum installations: provide galvanized steel enclosure with removable access panel, sized to house pump and elec. J-box with plug in outlet, to isolate all non-plenum rated components from air stream; seal all piping and electrical penetrations. The Contractor shall be responsible for coordinating all requirements for drain pump installation (electrical connections, drain termination, code compliance for ceiling plenum installations, etc.)

C. Condensing Units (CU): shall be a self-contained electrically operated unit, employing a factory assembled refrigeration circuit utilizing R-410A refrigerant. Access panels shall be provided for access to all parts requiring service. Provide all necessary tubing, piping, control circuits, and accessories required for a complete operating unit ready for operation after being set in place and connected to the associated refrigerant piping and utilities. Units shall be of the type indicated on the drawings.
   1. Compressors shall be scroll type, rated for service, and mounted on vibration isolators to minimize vibration and noise. Compressors shall be provided with compressor motor starter, compressor motor overload protection devices, crankcase heaters, anti-slugging protection, and time delay on recycling of the compressor. Internal compressor motor thermal cutouts and hot gas cut out shall protect compressor, in addition to high- and low-pressure safeties.
   2. Condenser coil shall be of aluminum fin/copper tube construction, specifically manufactured for refrigerant service. Coil shall be protected by a hail guard. Refrigeration circuit shall be factory assembled and fully charged, and shall include reversing valve, external service valves, refrigerant filter/drier and gauge ports on the suction and discharge of the compressor.
   3. Condenser fans utilized shall be of the propeller type, quiet in operation and adequately secured to shafts, with vertical discharge. Condenser fan motor shall be direct-drive type with permanently lubricated bearings.
   4. Condensing units (CU) shall be rated for continued operation in high (115 degrees F) ambient temperatures, with no reduction in equipment or component life.
   5. Provide seacoast protection for equipment.

2.2 DUCTLESS SPLIT SYSTEMS

A. General: The ductless split system shall be fully functional, providing cooling and heating in the capacities scheduled. The system shall consist of: indoor DX ductless split unit (DS), outdoor air-cooled condensing unit (CU), refrigerant line sets, condensate drainage, condensate pump, controls and electrical service, as described below.
   1. Manual and automatic controls, factory wired, and accessible for service and inspection, shall be provided. Controls shall include head pressure control, solenoid-operated

switchover valve, thermostatic expansion valve, reversing valve, and indoor temperature control.

B. Ductless Split Unit (DS): shall be a self-contained electrically operated unit with DX cooling, reverse cycle heating, and a washable resin filter. Units shall be provided with drain connection and integral pump (powered by Ductless Split Unit) for condensate drainage. Provide all necessary, piping, control circuits, and accessories required for a complete operating unit ready for operation after being set in place and connected to the associated refrigerant piping, drain, duct system, and utilities.
   1. Cabinet shall be heavy duty plastic polymer and steel with internal acoustical lining and removable panels for maintenance. A separate back plate shall be provided to secure unit to the wall.
   2. Coil shall be of aluminum fin/copper tube construction, specifically manufactured for refrigerant use with thermostatic expansion valve (TXV).
   3. Fans shall be direct-drive blower type. Fan shall have five (5) speed settings, plus Quiet and Auto settings. All fans shall be dynamically and statically balanced with permanently lubricated bearings. Manual adjustable guide vane shall be provided with the ability to change airflow from side to side. A motorized air sweep louver shall provide an automatic change in direction by directing the air up and down for uniform distribution.
   4. Return air filter shall be mildew proof, removable, washable type.
   5. Ductless split (DS) unit shall be powered by the outdoor condensing unit (CU).
   6. System shall be provided with a wall-mounted, programmable thermostat controller.
   7. CONDENSATE PUMP (at the Contractor's option): Vertical type condensate pumping unit with high impact polymer base tank, stainless steel shaft, safety switch, thermal overload protection, check valve, 1/30 HP motor, 120V/1ph 1.5A, to pump 25 GPH at 15 ft. of head, Little Giant model VCM-20ULS or approved equivalent. For return air ceiling plenum installations: provide galvanized steel enclosure with removable access panel, sized to house pump and elec. J-box with plug in outlet, to isolate all non-plenum rated components from air stream; seal all piping and electrical penetrations. The Contractor shall be responsible for coordinating all requirements for drain pump installation (electrical connections, drain termination, code compliance for ceiling plenum installations, etc.)

C. Condensing Unit (CU): shall be a self-contained electrically operated unit, employing a factory assembled refrigeration circuit utilizing R-410A refrigerant. Access panels shall be provided for access to all parts requiring service. Provide all necessary tubing, piping, control circuits, and accessories required for a complete operating unit ready for operation after being set in place and connected to the associated refrigerant piping and utilities. Units shall be of the type indicated on the drawings.
   1. Compressors shall be a variable speed, inverter drive type, vibration isolated from the chassis. Compressors shall be provided with compressor motor starter, compressor motor overload protection devices, crankcase heaters, anti-slugging protection, and time delay on recycling of the compressor. Internal compressor motor thermal cutouts and hot gas cut out shall protect compressor, in addition to high- and low-pressure safeties.
   2. Condenser coil shall be of copper fin/copper tube construction, specifically manufactured for refrigerant service. Coil shall be protected by a hail guard. Refrigeration circuit shall be factory assembled and fully charged and shall include reversing valve and refrigerant filter/drier.

3. Condenser fans utilized shall direct drive propeller type, with horizontal discharge. Condenser fan motor shall be inverter drive type with permanently lubricated bearings.
4. Condensing units (CU) shall be rated for continued operation in high (115 degrees F) ambient temperatures, with no reduction in equipment or component life.
5. Provide single point power connection for the system (ductless split (DS) and condensing unit (CU); ductless split (DS) shall be powered by the outdoor condensing unit (CU).

6. Provide seacoast protection for equipment.

2.3 INSTALLATION REQUIREMENTS

A. The systems must be installed by a factory trained contractor/dealer. Confirmation of system capacity and approval of refrigerant piping layout shall be by a factory certified system designer. Submittals to the Architect and Engineer shall show all complete design and details for a total system.

PART 3 – PRODUCTS

3.1 GENERAL

A. Contractor shall not purchase and/or install equipment until Architect/Engineer has reviewed shop drawings/submittals for compliance with engineer design concept.

B. Any equipment purchased and/or installed prior to the Architect and Engineer reviews, and found to be in non-compliance shall be removed or corrected as per instructions from Architect/Engineer, at Contractor’s expense.

3.2 EXAMINATION

A. Contractor to examine areas and conditions under which split systems air conditioners are to be installed and notify Architect in writing of those conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.3 INSTALLATION

A. General: Install split system air conditioners in accordance with manufacturer's installation instructions, in accordance with State and local Code requirements, and the Contract Documents.

B. Install units in locations shown on drawings. Provide proper clearances as required for all components. Coordinate carefully all nearby building structural components, etc. Clearance from each unit inlet to nearest obstruction shall equal or exceed manufacturer's minimum recommendations.

C. Contractor shall field coordinate routing of refrigerant piping with all trades and the field conditions. Routing shall be indicated on equipment and piping layout shop drawings.

D. Provide flexible connections at ductwork connections.

E. Coordinate all work with other trades as necessary for proper interfacing.

F. All equipment shall be protected from any form of damage. Any damaged equipment shall be replaced without additional cost.

G. Equipment intended for outdoor installation shall be completely weatherproofed.

H. Provide installation, operation and maintenance manual to the Owner.

3.4 FIELD QUALITY CONTROL

A. Testing: After installation of equipment has been completed, test unit to demonstrate proper operation at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

B. Start-up: The initial start-up shall be made by an authorized representative of the equipment manufacturer. Check fans for proper motor phasing, alignment, and vibration-free operation. Improperly aligned fans to be corrected. Change unmatched belts.

C. Test equipment in accordance with specification Section 23 05 93, “Testing, Adjusting, and Balancing.” The units shall be tested and adjusted to provide the scheduled capacities. All controls shall be tested and adjusted.

D. Training: The contractor shall provide manual describing all operating and routine maintenance service procedures to be used with the temperature controls. Contractor shall instruct the Owner's designated representatives in system/unit/controls operation and maintenance procedures. The duration of the instruction period shall be to the satisfaction of the Owner/Operator.

E. Verify that unit are interlocked and controlled as required.

F. Warranty: All construction, installation and control devices shall be warranted to be free from defects in workmanship and material for a period of one (1) year from the date of job acceptance by the Owner. Compressors shall carry an additional four (4) year “parts only” warranty. Any equipment or labor found to be defective during this period shall be repaired or replaced without expense to the Owner.

END OF SECTION 238126

SECTION 260000 - ELECTRICAL GENERAL

PART 1 - GENERAL

1.1 SCOPE

A. Attention is called to the fact that this is a renovation and/or addition to an existing facility which is required to remain in operation during construction. Contractor shall visit the site to become aware of existing conditions.

B. There are many interfaces between the work involved with this Division and the work in other Divisions, particularly with Division 23. Be aware of the responsibilities at the interfaces. The exact locations of apparatus, fixtures, equipment and raceways shall be ascertained from all concerned and the work shall be laid out accordingly. In addition, coordinate with all equipment suppliers and other trades to verify the actual installation requirements prior to rough-ins.

C. The plans and specifications are considered cooperative and complimentary. Where one contradicts the other, notify the Architect/ Engineer for clarification prior to any installation.

D. All applicable portions of the General and Specific Conditions are included herein by reference.

1.2 DEFINITIONS

A. Install: Receive, store, place, fix in position, secure, anchor, etc., including necessary appurtances and labor so the equipment or installation will function as specified and intended.

B. Furnish: Purchase and supply equipment and components, including shipping and receiving.

C. Provide: Furnish, install, connect, test, demonstrate and leave operational.

D. Wiring: Wire or cable installed in raceway with all required boxes, fittings, connectors, etc.

E. Work: Materials completely installed, including the labor involved.

F. Or approved equal: Equal in type, design, quality, appearance, etc. as determined by the Architect/Engineer.

G. Raceway: Galvanized rigid steel conduit (GRC), electrical metallic tubing (EMT), intermediate metal conduit (IMC), schedule 40 Polyvinyl Chloride (PVC), flexible steel (FLX), sheathed flexible steel (SLT), code gauge wireway (WW).

1.3 CODES AND REGULATIONS

A. All work shall comply with all local laws, ordinances and regulations applicable to the electrical and fire alarm/life safety system installation, NFPA, OSHA, ANSI, [SBC,] [BOCA,] [UBC,] municipal ordinances governing electrical work, and with the requirements of the latest approved edition of the National Electrical Code.

B. Where different sections of any of the aforementioned codes and regulations, the specifications or the plans require different materials, methods of construction, or other requirements, the most restrictive or stringent shall govern. In any conflict between a general provision and a special provision, the special provision shall govern.

C. Obtain all permits and licenses, and pay all fees as required for execution of the Contract. Arrange for necessary inspections required by the Architect, city, county, state and other local authorities having jurisdiction (LAHJ) and present certificates of approval to the Owner or his designated representative.

D. Under no circumstances will asbestos, or asbestos related materials, be allowed on this project.

E. Communicate with all required utility offices to meet utility schedules and regulations. Coordinate the local utility requirements with the requirements of these contract documents. Should conflicts arise, notify the Architect/Engineer immediately. Acquire services to avoid project delays. Conform to regulations of the local utility company with respect to metering, service entrance and service access.

1.4 SITE VISIT

A. All interested parties shall visit the site and thoroughly familiarize themselves with the local conditions and existing conditions which may affect the cost of the Work in advance of any project activity or submission of bids.

B. Where work under this Division requires extension, relocation, reconnection or modifications to the existing equipment or systems, the existing equipment or systems shall be restored to their original condition prior to completion of this Project.

C. No allowances will be made for lack of knowledge of job conditions which could reasonably be identified during site visit.

D. Verify the service entrance voltage and short circuit contribution with the serving power utility and provide written confirmation of same to the Architect prior to submitting shop drawings or ordering any materials for use in the building served. Provide service entrance equipment fully rated to interrupt the available fault current from the serving utility.

1.5 DRAWINGS AND SPECIFICATIONS

A. The Electrical Drawings are diagrammatic, and are not intended to show the exact location of raceways, outlets, boxes, bends, sleeves, fire sealant, couplings or other such elements except where dimensions are noted. Provide all required offsets, extensions or pull boxes required for a fully coordinated and operational system.

B. The Drawings and Specifications shall both be considered as part of the Contract. Any work or material shown in one and omitted in the other, or which may fairly be implied by both or either, shall be provided in order to give a complete job.

C. Should conflicts exist between the Drawings and Specifications, notify the Architect/Engineer for clarification prior to installation.

D. Refer to the Architectural {Interiors), Structural and Mechanical plans, Civil, Kitchen and other project construction and shop drawings and details for dimensions, and fit the work to conform to the details of building construction.

E. Review the drawings for door swings, cabinets, millwork, counters and other built-in equipment. Coordinate installation of the electrical equipment with structural systems and mechanical systems such that full maintenance access is provided.

F. The right is reserved to shift any switch, receptacle, ceiling outlet or other outlet a maximum of 10'-0" from its location as shown before it is permanently installed, without incurring additions to the Contract in time or cost. In addition, refer to the Architectural Drawings for exact location of devices and equipment.

G. All conduit and wiring shown on the Electrical Drawings shall be provided under this Division regardless of its function.

H. Review the drawings and specifications provided for other systems such as Elevator Equipment, Sound System, CATV, Computer, Landscape, etc., for additional work which may be required under this Division. Provide service to and make connections to all such equipment requiring electrical service.

I. Equipment configuration is based upon one manufacturer's product. Where the equipment selected by the Contractor for use on this Project differs from the configuration shown, the Contractor shall be responsible for coordinating space requirements, connection arrangements, interfaces with mechanical and plumbing equipment and all other affected trades and providing access for future maintenance and repair. Submit proposed revisions for approval by the Architect/Engineer.

1.6 DEVIATIONS

A. No deviations from the drawings and specifications shall be made without the full knowledge and consent of the Architect/Engineer.

B. If it is found that existing conditions make desirable a modification in requirements covering any particular item, report such item to the Architect/Engineer for their decision and instructions.

1.7 EQUIPMENT CONNECTIONS

A. The horsepower, wattage (or amperes) of mechanical equipment indicated is the estimated requirement of equipment furnished under another Division. All wiring, protective devices and disconnect switches shall be of the voltage, size and ampacity required for the actual equipment installed, without increase or additional costs. In no case shall these items be of smaller capacity than permitted by National Electrical Code.

B. Coordinate with other trades and review the drawings of other divisions and provide suitable control equipment and feeders/branch circuits so that the above requirements shall be met without incurring additions to the Contract in time or cost. Conform with UL Listing and nameplate requirements for equipment furnished. Such adjustments shall be subject to the approval of the Architect/Engineer.

C. Provide suitable overcurrent protection and disconnecting means in conformance with the requirements of the NEC, for all items or equipment utilized on the project no matter how, or

by whom, furnished. However, duplication, or redundancy, is not required. Coordinate said requirements with equipment furnished and with applicable trades.

D. Branch circuits supplying control panels and other equipment master and local unit locations and quantities shall be coordinated at the submittal stage and provided under Division 26. Provide emergency power where required to accomplish emergency equipment operations in accordance with Division 23 requirements. All control wiring for plumbing and heating, ventilation and air conditioning systems shall be installed under Division 23. Review Division 23 specifications and shop drawings for control systems to assure system compatibility between equipment furnished under Division 16 and system wiring and controls furnished under Division 23.

E. Motor controllers shall be furnished and installed by Division 26 where automatic control of equipment is required, unless specified to be furnished as an integral part of packaged equipment. Provide the number and type of auxiliary contacts and relays necessary to interlock the equipment and provide the specified control sequence, reserving spare NO and NC contacts for future use. Power wiring to all motors and motor controllers and between motors and controllers shall be furnished under Division 26.

F. Where drawings indicate or specifications require equipment to be controlled by line voltage interlock, safety device or control, provide line voltage control wiring in Division 26.

G. For each electrical connection required, provide pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire connectors, and other items required to complete splices and terminations of the necessary types. Cover splices or terminations with electrical insulation equivalent to insulation of conductors terminated.

1.8 ELECTRICAL OUTAGE SCHEDULING

A. Electrical work requiring interruption of electrical power which would adversely affect the Owner’s operation shall be done at times other than normal working hours. Coordinate with Owner to establish normal working hours for this facility.

PART 2 - PRODUCTS

1.9 STANDARDS FOR MATERIALS AND WORKMANSHIP

A. All material shall be new and shall bear the inspection label of Underwriter's Laboratories, Inc. (UL).

B. The published standards and requirements of the National Electrical Manufacturer's Association (NEMA), Underwriters' Laboratories (UL), Electrical Testing Laboratories (ETL), American National Standards Institute (ANSI), Institute of Electrical and Electronic Engineers (IEEE), Insulated Cable Engineers Association (ICEA), National Fire Protection Association (NFPA) and the American Society for Testing and Materials (ASTM) shall govern and apply where such have been established for the particular material in question.

C. Specified catalog numbers and trade or manufacturers names are intended to describe the material, devices, or apparatus desired for type, construction features, electrical characteristics, ratings, operating functions, style and quality. Similar materials of other manufacturers, not less than specified quality, capacity or character may be substituted in

conformity with the provisions of the General and Supplementary Conditions. Materials of the same type shall be the product of one manufacturer. Refer to Shop Drawing requirements.

D. Furnish all materials specified herein or indicated on the drawings.

E. All work shall be installed in a practical and workmanlike manner by competent workmen, skilled in their trade.

1.10 SHOP DRAWINGS

A. Provide complete electrical characteristics for all equipment. Submit for approval data of the materials and equipment to be incorporated into the Work. Submittals shall include descriptive materials, catalog cuts, diagrams, performance characteristics, and charts published by the manufacturer indicating conformance to the specification and drawing requirements; model numbers alone will not be acceptable. Submittals shall be made by Specification section number, tabbed, grouped and submitted in packages as indicated below. Submittals for lighting fixtures shall include full photometric data. Electronic submittals are preferred. Shop drawings shall be submitted for the following equipment and items:

Package I:
Section 26 05 19 Wires and Cables
Section 26 05 33 Raceways
Section 26 05 34 Boxes and Fittings
Section 26 27 26 Wiring Devices

Package II:
Section 26 24 13 Switchboards
Section 26 24 15 Distribution Panelboards
Section 26 24 16 Panelboards
Section 26 28 16 Motor and Feeder Disconnect Switches
Section 26 32 13 Emergency Power System

Package III:
Section 26 51 00 Lighting

Package IV:
Section 28 31 00 Life Safety System

Package V:
Section 26 41 13 Lightning Protection
Section 26 43 13 Surge Protection

A. Shop drawings and/or catalog data submittals on all items of equipment and materials shall be submitted in conformity with requirements of the General and Supplementary Conditions. Do not submit more than the required number of sets. Do not submit equipment or materials not requested in the Specifications.

B. All material lists and shop drawing submittals shall include a stamped indication by the Contractor signifying that the submittals have been previously reviewed for complete compliance with the Contract Documents, that all coordination required between trades prior to field installation has occurred and that the material being submitted is approved for installation. The stamped indication shall include the name of the contracting firm, the date of the review and the signature of the contractor. The Engineer will not review the shop drawing submittals without the contractor's stamped approval already on the shop drawings. The

responsibility of complying with the Contract Documents will not be relieved by the Engineer's review, which requires 10 working days from the date the shop drawings are received by the Engineer.

C. All pricing is to be based upon the products, manufacturers, and processes described in the Contract Documents. Requests for approval of substitutions shall be written and delivered to the Architect's/Engineer's office in conformity with the provisions of the General and Supplemental Conditions. Do not submit any shop drawing or product data that does not conform with the contract documents.

D. Resubmittals, if necessary, shall be made as specified above. Resubmittals will highlight and indicate any and all revisions made thereto and will include the following text "Resubmittal #___", typed in a prominent location on the cover sheet.

E. The Contractor shall provide with the shop drawing submittal dimensioned layouts of all electrical rooms and spaces (including Server/IT rooms) using the equipment he intends to furnish. Switchboard, panelboards, distribution panels, etc., will be rejected without dimensioned room layouts.

F. Samples of all materials proposed for use shall be presented to the Architect for his approval when requested.

G. Submittals shall be noted with any deviations, alterations or limitations of product from the specified materials. The product will be rejected upon failure to indicate this information. Any conflict or failure to perform comparably to the originally specified materials will result in product rejection. It will be the Contractor's responsibility to replace the alternate material or equipment with the originally specified one and to demolish, replace, repair and retest the equipment, including repair or replacement of any component of the building, finishes or other systems affected by said replacement, at no additional costs to the Owner.

1.11 SUPPORT FASTENER DEVICES

A. Anchors for post tensioned concrete applications shall be cast in place continuous or spot insert channel providing a safety factor of 3 in 3000 lb hard rock concrete.

B. Anchors for cast in place concrete shall be insert type expansion shields and bolts, lead shields and bolts or self drilling expansion shields and bolts. Powder actuated pins of 1500 pound pull out strength may be utilized in concrete.

C. Anchors for wood construction shall be lag bolts or power driven wood screws.

D. Anchors in hollow masonry shall be toggle bolts.

E. Anchors for steel attachment shall be machine screws, bolts, or beam clamps.

F. Equipment mounted to drywall construction shall be secured to power channel (13/16” x 1 5/8” minimum). Secure channel to a minimum of two (2) dry wall studs with drywall screws and washers.

1.12 SUPPORTS

A. Furnish and install under this contract all angle iron, channel iron, rods, threaded rod, supports or hangers required to install or mount all electrical equipment, material or related devices. Conduit shall not be supported from steel decking, roof decking, bridging, ceiling or ceiling support wires.

1.13 IDENTIFICATION

A. All equipment or devices specified in Division 26 shall be identified with an engraved plastic nameplate. Identification of flush equipment shall be on the inside of the cover. Surface equipment shall be identified on the outside. Plastic nameplates shall be multicolored laminated plastic with engraved lettering. Nameplates shall be provided as scheduled:

1. 208/120 volt normal power equipment shall be white faceplate/black core.
2. 208/120 volt emergency power equipment shall be white faceplate/red core.

B. Refer to electrical details for lettering size and nameplate requirements.

1.14 AS-BUILT (RECORD) DRAWINGS

A. Maintain on the job site at all times during construction a set of "As-Built" drawings with all changes during construction marked thereon. This set shall be utilized for no other purpose. Include any addenda, change orders, field orders, project sketches or "marked-up" drawing prints as may be generated on the job site to assist in recording the changes.

B. The "As-Built" drawings shall show all changes and deviations from the Contract Drawings including relocation of outlets, conduit and equipment. Record final dimensioned locations of switchboards, panelboards, transformers, disconnect switches, etc. Make sufficient measurements to locate all underground conduit. Show exact locations of underground cable and conduits, both interior and exterior, fully dimensioned from building column lines or permanent exterior structures. These drawings shall be available for reference at the time of final inspection.

C. At the completion of construction, the Contractor shall acquire a set of electronic files from the Architect/Engineer for the purposes of creating the final record as-built set. All changes noted above shall be incorporated thereon by the Contractor. The final set of plans, marked as "As-Built", shall be presented to the Owner for his use/record.

1.15 MAINTENANCE AND INSTRUCTION MANUALS

A. Submit to the Architect/Engineer, upon completion of the work and prior to final inspection, copies of maintenance and instruction manuals for equipment provided as outlined below:

1. Three sets of the following data are required:

a. Operating and maintenance instructions.
b. Spare parts list.
c. Copies of approved submittal data.
d. Copies of panelboard circuit directories reflecting all field changes.
e. Test reports of all tests performed.
f. Certificates of inspection from LAHJ.
g. Contact names and phone numbers for parts suppliers of submitted equipment.

B. Arrange each set of data in an orderly way and bind each set in a separate 3-ring hard-cover binder (or electronic format – coordinate requirement with Owner) with appropriate label identifying the Project, Architect, Engineer, Contractor, Subcontractor and Date.

1.16 SUBMISSION OF DRAWINGS

A. Submission of Engineer's drawings for shop drawings and unaltered Engineer's drawings for "As-Built" will not be acceptable.

1.17 SPARE PARTS AND ATTIC STOCK

A. Prior to final inspection, turn over to the Owner the following materials of the type and quantity specified. Material shall be new, in original shipping containers or cartons, of the same manufacture and type as installed on the Project. Obtain receipt for all materials turned over to the Owner.

1. Lamps - Ten percent of each lamp type.
2. Fuses – Ten percent of each size.
3. Ballasts - Ten two-lamp ballasts and ten one-lamp ballasts.

PART 3 - EXECUTION

1.18 COORDINATION

A. Before any piping, conduit, outlets, equipment or lighting fixtures are located in any area, coordinate the space requirements with all trades. Such shall be arranged so that space conditions will allow all trades to install their work, and will also permit access for future maintenance and repair. Coordinate the installation of recessed electrical equipment with concealed ductwork, piping, insulation, structural appurtenances and wall thickness.

B. Piping, ductwork, conduit and equipment installed at variance with the above requirements shall be relocated and/or revised to conform with the above requirements without incurring additions to the Contract.

C. Coordination of space requirements with all trades shall be performed so that:

1. No piping or ductwork, other than electrical, shall be run within 42" of panelboards, switchboards or transformers.
2. No pipes or ducts that operate at a temperature in excess of 120 degrees F. shall be installed nearer than 3" to any electrical conductor.

D. Do not scale drawings. Obtain dimensions for layout of equipment from the Architectural drawings unless noted on the Electrical drawings.

E. Contractor for work under this division shall be fully responsible for determining in advance of purchase that proposed equipment and materials for installation shall fit into the confines indicated and allow sufficient clearance for maintenance and service of all equipment including other trades.

F. Clearances in front of electrical switchboards, panelboards, motor starters, bus plugs etc. (equipment requiring maintenance while energized) shall be installed in accordance with N.E.C. 110.26. Further, NEC clearances shall also be maintained in front of mechanical equipment that may require service while energized.

1.19 PROTECTION OF MATERIALS

A. Refer to the general requirements section of the Specifications for storage, protection and handling requirements.

B. Provide dry, weathertight staging and storage for materials and equipment requiring protection from weather and moisture per manufacturer's recommendations. Install temporary lighting or heat sources to prevent moisture accumulation. Provide protection against direct sunlight, precipitation, wind, ice, fire or excessive heat. Store materials in original undamaged packaging with manufacturer's labels and seals intact. Containers which are broken, damaged or watermarked are not acceptable and are subject to rejection.

C. Materials and equipment will not be installed until the environmental conditions of the project are suitable to protect same per manufacturer's recommendations. Equipment or materials damaged or subjected to moisture, precipitation, direct sunlight, cold or heat are not acceptable and shall be removed from the project and replaced at no additional costs to the Owner.

D. All conduit and other openings shall be kept protected to prevent entry of foreign matter or construction debris. Fixtures, equipment, and apparatus shall be kept covered for protection against dirt, water, chemical or mechanical damage before and during construction.

E. The original finish, including shop coat of paint of fixtures, apparatus or equipment that has been damaged shall be restored without incurring additions to the Contract in time or price.

1.20 HOUSEKEEPING PADS

A. Provide 4" minimum height concrete pad, integral with floor, under all floor mounted electrical equipment or apparatus.

1.21 CUTTING AND PATCHING

A. The Contractor is responsible for all cutting and patching, including escutcheon plates where necessary, whether or not such cutting and patching is shown or indicated.

1.22 CLEANING AND PAINTING

A. Remove foreign materials, drywall compound, overspray, oil, dirt and grease from all raceway, fittings, supports, boxes, cabinets, pull boxes, panelboard trims and equipment to provide clean surfaces for painting. Remove surface oxidation and restore galvanized surfaces with cold process galvanizing compounds. Touchup marred or scratched surfaces of fixtures, panelboard and cabinet trims, motor control centers, switchboards, cabinets, and equipment enclosures with paint furnished by the equipment manufacturer specifically for that purpose. When touchup is required, provide one base coat over imperfection and subsequent coat over entire side or surface of equipment.

B. Do not paint trim hinges, latches, clamps, locks, device covers or trim covers. Mask or remove such items prior to finishing.

C. Unless otherwise noted herein, all painting shall conform to the "Painting" section of the specifications.

D. Where plywood backboards are utilized to mount electrical or electronic equipment provided under Division 16, finish same with two (2) coats of light gray semi-gloss paint.

1.23 ACCESS TO ELECTRICAL ITEMS

A. Install all concealed electrical equipment, junction and pull boxes, apparatus, or devices so as to maintain access for maintenance, operations and replacement. Access doors or covers shall be provided where required by NEC or LAHJ and shall be installed in accordance with manufacturer's instructions. Refer to the Architect for approved types, means, methods and appearance. Locate each access unit accurately in relation to electrical work requiring access.

1.24 ELECTRICAL ROOMS AND CLOSETS

A. Manufacturer's equipment shall not be larger than that dimensioned, or scaled, on plans. Conflicts shall be brought to the attention of the Architect, for resolution prior to ordering equipment.

B. Clear working space in electric rooms and closets shall be no less than required by the N.E.C.

C. Submit for review, prior to construction or purchase of any equipment, scaled drawings of electrical rooms, closets, or spaces showing, in detail, planned installation locations of the equipment. These shall clearly show compliance with A and B above.

1.25 EQUIPMENT CONNECTIONS

A. Review all divisions of specifications, where equipment requiring electrical service is specified, to determine the complete scope of work under this division of the specifications. Provide electrical connections and service to all equipment specified elsewhere requiring such connections or service.

B. Connect all equipment requiring electrical connections, in accordance with the equipment manufacturer's requirements. Where equipment connections require specific locations, determine and coordinate same with submittals. Provide concealed service to central plant equipment locations and pads.

1.26 NAMEPLATES AND IDENTIFICATION

A. Provide and install nameplates for transformers, switchboards, switchgear, power and lighting panels, disconnect switches, time switches, pull boxes, junction boxes, fire alarm equipment, contactors, relays and other unit equipment. Nameplates shall be affixed with epoxy cement.

B. Install nameplates plumb and level.

C. Provide and install sleeve type wire markers on all conductors at all termination points and access points. Branch circuit identification (as LP-21") shall be installed on hot and neutral conductors. Dedicated circuits and isolated ground technical power circuits shall have wire markers installed on ground conductor. Label junction and pull box covers with all circuit numbers contained therein.

D. All electrical equipment, such as switchboards, panelboards, motor control centers, and meter socket enclosures, shall be labeled with an Arc-Flash Hazard Warning sticker as required by NEC 110.16. The warning sticker shall be located so as to be clearly visible to personnel before opening any equipment for servicing, examination, maintenance, or adjustment. This requirement applies to all panelboards on the project; the exception for dwelling units shall not apply.

1.27 EXCAVATION AND BACKFILLING

A. Provide and perform all excavation required to install conduit, ductbanks and manholes indicated on the drawings and/or specified. Trenches shall be of uniform width required with minimum 8" clearance on both sides. Remove and dispose of all materials not to be used for backfill. Maintain dry excavations for electrical work, by removing water. Grade areas to prevent surface water from entering excavation. Remove any accumulated water by pumping. Perform all excavation by open cut. Excavate with vertical-sided excavations where possible. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition. Establish requirements for trench shoring and bracing to comply with local codes and LAHJ. No tunneling shall be permitted.

B. The bottom of all trenches and excavation shall be graded to provide uniform bearing surface for conduits or ductbanks on undisturbed soil at every point along entire length. Tamp overexcavation with specified backfill materials. Remove unstable materials unsuitable for supporting equipment or installation and replace with specified materials for a minimum of twelve (12) inches below invert of equipment or installation.

C. Specified materials shall be utilized for backfilling, in not more than six (6) inch layers and tamped until the installation has cover of not less than the adjacent grade and not more than two (2) inches above same. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger the work or other property. Equalize backfilling operation to avoid shifting of materials and equipment installed. Compaction of backfill materials shall be at least equal to surrounding undisturbed material. Backfill trenches with concrete where excavations pass within 18" of footings or other utility lines. Do not settle backfill with water. Conform to compaction requirements and methods specified elsewhere.

1.28 TESTS AND CERTIFICATIONS

A. Upon completion of the electrical work and prior to final inspection, conduct an operating test in the presence of the Owner and the Architect/Engineer or his designated representative.

B. The installation shall be demonstrated to operate in accordance with the Contract Documents. Any material or workmanship which does not meet with the approval of the Architect/Engineer shall be removed, repaired or replaced as directed without incurring additions to the Contract in time or cost. All electrical systems shall be tested for compliance with the specifications.

C. Furnish all instructions, tools, test equipment and personnel required for the test. Have sufficient tools and personnel available to remove equipment covers, coverplates, etc., as

required for review of internal wiring and proper inspection. Provide hand tools, flashlights, ladders, outlet testers, VOM, meters and keys required to access and observe system operation and characteristics. Turn circuits on and off as directed and demonstrate operation of equipment as directed.

D. Contractor shall test all wiring and connections for continuity and grounds by Megger testing. Provide infrared scans on all connections. Upon indication of defective insulation, Contractor shall remove and replace the defective conductor and demonstrate by testing that the new conductor is acceptable. Upon detection of faulty connections by IR scan, Contractor shall tighten, adjust and/or replace any defective parts at all subject connections. Record feeder load currents and line voltages measured at each transformer, switchboard and panelboard after installation of all equipment and lighting. Adjust transformer taps as required to provide optimum voltage levels. Adjust single phase load connections to balance feeder load and document on as-built drawings. Provide the Owner with full documentation of all testing for future reference.

E. Refer to the individual specification sections and the electrical systems testing section of the specifications for specific testing requirements.

F. The authorized manufacturer's service representative shall review systems and equipment for correct operation, conformance with specification requirements and manufacturer's requirements and submit certification indicating above mentioned conformances for the following systems:

1. Life Safety System
2. Emergency Generator Set
3. Automatic Transfer Switches
4. Fire Communications System
5. Interfaces to Mechanical & Building Systems

1.29 DEMONSTRATION AND INSTRUCTION

A. Present to the Owner and the Architect/Engineer or his designated representative a physical demonstration and oral instructions for proper operation and maintenance of each of the electrical equipment and systems installed. Authorized manufacturer's representatives familiar with the specified equipment shall conduct training for the following systems:

1. Life Safety System
2. Emergency Generator Set
3. Automatic Transfer Switches
4. Fire Communications System
5. Interfaces to Mechanical & Building systems

1.30 TEMPORARY WIRING

A. Provide a temporary electrical lighting and power distribution system of adequate size to properly serve the construction requirements, including adequate feeder sizes to prevent excessive voltage drop. Temporary work to be installed in accordance with the National Electrical Code, Article 305, and as required by OSHA or applicable local safety codes, rules and regulations.

1.31 WARRANTY

A. All systems and components shall be provided with a one-year warranty from the time of final acceptance. The warranty shall cover all defects in materials, design and workmanship. During this warranty period, all defects in materials and workmanship shall be corrected without incurring additions to the Contract. The correction shall include removing the defective part(s), replacing and installing the new parts (including shipping and handling), all required cutting, patching, repainting, or other work involved, including repair or restoration of any damaged sections or parts of the premises resulting from any fault included in the warranty, entirely at the expense of the Contractor.

B. In addition to this general warranty, present to the Architect any other guarantees or warranties from equipment or system manufacturers. These supplemental guarantees or warranties shall not invalidate the general warranty.

END OF SECTION 260000

SECTION 260519 - WIRES AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260000.

B. This Section covers the furnishing, installation and connections of the building wiring system. Interior wiring, power distribution, lighting, appliance and equipment, motor and exterior wiring systems extending beyond the building are included. The wiring system shall be complete from electrical service entrance to every electrical device requiring an electrical connection.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Conductors shall be copper of 98% conductivity, soft temper, 600 volt insulation. Sizes specified are American Wire Gage (AWG) for No. 4/0 and smaller and thousand circular mils (kcmil) for all sizes larger than No. 4/0. Service entrance conductors shall be 600 volt, type XHHW.

B. Conductors No. 10 and smaller shall be solid and type "THHN" / THWN" insulation. No. 8 and larger shall be stranded and type "THHN" / "THWN" or “XHHW” insulation.

C. All wire and cable shall be U. L. Listed and shall bear the U. L. Label.

D. All conductors shall have size, grade of insulation, voltage and manufacturer’s name permanently marked on the exterior at maximum 24 inch intervals.

E. Conductor size shall be a minimum of No. 12 AWG. Conductor size shall be not less than indicated on the drawings. The minimum size of all emergency circuits shall be No. 10 AWG.

F. Fixture wire shall be No. 14 AWG silicone rubber insulated, stranded fixture wire, Type THHN (90 degrees C.).

G. Control conductors for use on 120 volt control wiring shall be No. 14 AWG stranded Type THHN/THWN, unless indicated otherwise on the drawings or as required for compliance with voltage drop requirements.

H. Where cables are used for switch leg, the white conductor shall be permitted to supply the switch, but not as a return to the switchboard outlet for 277 volt lighting switch legs and phase conductor shall be.

2.2 PREFABRICATED CABLE ASSEMBLIES

A. Metal clad cable type MC may be utilized for concealed branch circuit wiring only as permitted by local authority having jurisdiction. Insulated ground conductor shall be provided.

2.3 CONNECTORS

A. Terminations and connections shall be made with U.L. Listed connectors applied per manufacturer's recommendations.

B. Connections of #10 AWG and smaller size power and lighting branch circuit conductors shall be made with insulated spring steel wire nut connectors. Size #8 AWG and larger connections shall be made with hydraulically applied compression type connectors with insulated covers.

C. Connections of special system conductors shall be made via dedicated terminal strips labeled to indicate wire number and system type. Wire nut connections in system junction box are not acceptable.

2.4 ALTERNATE MATERIAL DESCRIPTION: (OPTIONAL)

A. Where permitted by local authority having jurisdiction, aluminum conductors may be utilized for conductor sizes No. 4/0 and larger in lieu of copper conductors specified and indicated on the drawings. Insulation of aluminum conductors shall be identical to insulation specified and indicated for copper conductors. Aluminum conductor's sizes shall be based upon not less than equivalent copper ampacities per NEC Table 310.15(B)(16) and voltage drop characteristics. Submit table of proposed substitution for review and approval in accordance with submittal requirements.

B. Fittings utilized to terminate aluminum conductors shall be compression type, U. L. Listed for the application.

C. Where aluminum conductors are utilized, raceways shall be increased in size in accordance with the conduit fill limitations of the National Electrical Code. Derating factors of NEC 310.15(B)(2) shall be applied, where applicable. As-built drawings shall reflect the size of aluminum conductors and raceway installed.

2.5 ACCEPTABLE MANUFACTURERS

A. Wire and Cable products:

1. Southwire Co.
2. Alcan Cable
3. AFC Cable Systems
4. Cerro Wire & Cable
5. General Cable

B. Signal Cable products:

1. Belden
2. Continental
3. Dekoron
4. West Penn

C. Connector products:

1. TYCO Electronics

2. FCI
3. Eagle
4. Gould Electronics
5. Ideal
6. O-Z Gedney
7. Thomas & Betts
8. Ilsco
9. Buchanan
10. King

D. Wire management products:

1. TYCO Electronics
2. Thomas & Betts
3. Panduit
4. Wieland

E. Wire & Cable identification products:

1. Thomas & Betts SM series
2. Wieland
3. Brady

F. Wire Pulling lubrication products:

1. Ideal Yellow 77

PART 3 - EXECUTION

3.1 WIRING

A. All conductors shall be installed in conduit, unless noted otherwise. All conductors shall be pulled in at the same time. No conductors shall be pulled into the conduit until the conduit system is complete and plaster/drywall construction has dried. Clean, swab and evacuate conduit system before pulling in conductors. Do not exceed the manufacturer's maximum pulling tension.

B. Conductors shall be continuous from outlet to outlet and from outlet to junction box or pull box. All splices and joints shall be carefully and securely made to be mechanically and electrically solid with proper U. L. Listed connectors. Where connection is made to any terminals of more than 30 amperes capacity and where conductors larger than No. 10 are connected to any terminal, copper terminal lugs shall be secured to the conductors. Where multiple connections are made to the same terminal, individual lugs for each conductor shall be used.

C. Each conduit shall have a minimum of three (3) conductors pulled in unless that particular conduit is noted as being for systems other than electrical circuitry and/or future use or unless noted otherwise. Grounding conductors are not shown in wire count, but are required from circuit origin to last device.

D. Conductors for lighting and receptacle circuits shall have color coded jackets. The wiring shall be color coded with the same color used with its respective phase through the entire job as follows:

208/120 Volt Systems	Type	480/277 Volt Systems
Black	Phase A	Brown
Red	Phase B	Orange
Blue	Phase C	Yellow
White	Neutral	Gray
Green	Ground	Green/tracer
White/Green Stripe	IG Neutral	Black w/ Black Stripe
Green/White Stripe	IG Ground	Green

E. The feeder and service entrance conductors shall be color coded by the use of one (1) inch wide colored plastic tape applied within 6" of each conductor end.

F. Branch circuit conductors shall not be smaller than No. 12 and where the home run from panel to first device exceeds 60'-0", the conductors from home run outlet to panel shall be No. 10 minimum.

G. Branch circuit wiring which supplies more than one fluorescent fixture through wireway of other fixtures shall be rated for use at 105 degrees C.

H. For branch circuits terminating in outlet without device, leave minimum of 12" of slack wire coiled for connection of equipment.

I. All conductors shall be identified with proper circuit numbers at all access points, terminals, junction boxes and at panelboards within 6" of conductor ends.

J. Special systems conductors shall be color coded in accordance with system manufacturer's recommendations or in a manner approved by the Engineer.

K. Furniture system branch circuits shall have minimum #10 neutral home run conductors pulled to system junction box.

L. Maintain phase rotation established at service entrance point throughout entire project.

M. Taps and splices, where permitted by these specifications, shall be performed with an encapsulating watertight connection kit which insulates and moisture seals the connection.

N. Grounding conductors are not indicated in the wire count shown on the drawings, but are required in all branch circuit and feeder installations. Provide insulated ground conductor (sized per NEC requirements) in all raceways.

3.2 CONTROL WIRING

A. Control wiring is defined as the wiring which provides connections between control circuit elements and does not provide the power circuit.

B. Generally, control wiring is specified in Division 23; however, where a control device such as a push-button, thermostat, firestat, etc. is to be installed in the power circuit, these devices shall be received, stored and installed as part of the work of this Division. Control wiring, conduit etc. shall be coordinated with division 23 and provided as required.

3.3 CONNECTIONS

A. All connectors shall be U.L. Listed and shall be utilized in full accordance with manufacturer's requirements.

B. Splices shall be made only where specifically approved by the Engineer. Conductors shall be continuous from origin to first outlet box or manhole. Splices made exterior to the structure, or below grade, shall be compression type connections with insulated, waterproof covers. Submit splicing requests for review and approval prior to installation.

C. Termination lugs shall be applied to all single cables #8 and larger, and shall be compression type fittings. The use of mechanical type lugs, kerneys or other pressure type connections will not be permitted.

D. All compression connections shall be long barrel type installed using hydraulic tools designed for the purpose.

E. Insulated spring steel wire nut connectors shall be used for branch circuit connections of #10 and smaller conductors. Connections of #8 and larger sizes shall be made with compression type connections with insulated covers. Where exposed to moisture or corrosion spring steel wire nut connectors shall be silicone filled.

F. Control and special system riser and junction boxes shall be fitted with terminal strips and all conductors shall be labeled per system requirements. The installation of wirenuts in special system riser and junction boxes is not acceptable.

G. Phase rotation at service equipment shall be maintained throughout entire project, color coding of conductors shall be consistent for feeders and branch circuits throughout entire project.

3.4 IDENTIFICATION

A. All conductors shall be identified with full circuit number at all access points, boxes, and at panelboards within 6 inches of conductor end. Identification shall be permanently marked PVC split sleeve or tubing type

B. Tape or laminated type wire markers are not acceptable

C. Permanently mark the junction box cover with the circuit numbers for all conductors contained within. Utilize black marker for normal power and red marker for emergency power and fire alarm.

3.5 WIRE MANAGEMENT

A. Power and control wiring within all special system cabinets and enclosures, and within switchboards and electrical equipment shall be bundled or routed within slotted wiring duct in a workmanlike manner.

B. Any knockout, cutout or slot containing wiring shall be fitted with bushing or continuous grommet strip to avoid fraying or abrasion.

C. Train and lace all conductors within panelboard or control enclosures with cable ties or spiral wrapping.

D. Spare conductors installed shall be identified and capped.

END OF SECTION 260519

SECTION 260526 - GROUNDING

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260000.

B. This section covers the installation of the building grounding system. The grounding system shall be established with equipment grounding conductors; the use of metallic raceways as the only method of equipment grounding is not acceptable.

C. In addition, this section covers ground fault protection for the main service entrance equipment.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. Grounding electrode conductors shall be bare or green insulated copper conductor sized as indicated on the drawings.

B. Equipment grounding conductors shall be green **insulated** type THHN/THWN, or XHHW conductors sized as indicated on the drawings. Where size is not indicated on the drawings, conductor size shall be determined from the National Electrical Code table on sizes of equipment grounding conductors.

C. Bonding jumpers shall be flexible copper bonding jumpers sized in accordance with the National Electrical Code tables for grounding electrode conductors.

2.2 PANELBOARDS, TRANSFORMERS, MOTOR CONTROLLERS, AND DISCONNECT SWITCHES

A. Provide each low voltage distribution and branch circuit panelboard with a copper equipment grounding bar brazed or riveted to the associated enclosures or cabinet and an insulated neutral bar.

B. Provide a conductor termination grounding lug bonded to the enclosure of each equipment item.

2.3 DEVICES

A. Each receptacle and switch device shall be furnished with a grounding screw connected to the metallic device frame.

2.4 GROUND RODS

A. Ground rods shall be 3/4" x 10'-0 copper clad steel.

B. Sectional ground rods shall be hot dip galvanized 5/8" x 10' sections with an internal stainless steel splined coupling pin.

2.5 HYDRAULIC TERMINATIONS

A. Acceptable manufacturers for hydraulically applied terminations are Square D, Burndy and Thomas and Betts (T & B).

B. Acceptable manufacturers for mechanically applied terminations are Ideal, Burndy and Thomas and Betts (T & B).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ground all non-current carrying parts of the electrical system, i.e. raceways, equipment enclosures and frames, junction and outlet boxes, machine frames and other conductive items in close proximity with electrical circuits, to provide a low impedance path for potential grounded faults.

B. Service entrance and separately derived electrical systems, grounding electrode system:

1. The neutral conductor of the electrical service serving the premises wiring system shall be bonded to the ground bus bar in the service equipment which shall be bonded to the cold water system, the ground rod system, and other grounding electrodes specified herein or indicated on the drawings. Grounding electrode conductors shall be installed in rigid, nonmetallic conduit to point of ground connection, unless subject to physical damage in which case it shall be installed in galvanized rigid steel. Where metallic conduit is permitted, bond conduit at both ends to grounding electrode conductor with a U.L. bonding bushing. Bonding conductor shall be the same size as the grounding electrode conductor.
2. Make connection to main water line entering the building. Make connections ahead of any valve or fittings whose removal may interrupt ground continuity. Install a bonding jumper of the same size as the grounding conductor around the water meter.
3. Bond together the following systems to form the grounding electrode system. All system connections shall be made to the electrodes as close as possible to the service entrance equipment and each connected at the service entrance equipment ground bus. Do not connect electrode systems together except at ground bus.

    a. Cold water piping system
    b. Ground rod system
    c. Lightning protection system
    d. Steam and chilled water piping
    e. Main rebar in foundation footing
    f. Building structural steel components.

4. Bond the neutral of all dry type transformers to the nearest building structural steel. In reinforced concrete structures, utilize a #4/0 cu. conductor riser tied back to main switchgear which shall serve as the grounding electrode for the separately derived

systems. Make connection to building steel with chemical weld type connector, in a location in unfinished space where the connection will not be subject to physical abuse.

5. Bond the neutral and frame of the emergency generator to building steel and the ground rod system, which shall serve as the grounding electrode for the separately derived system. In reinforced concrete structures building steel shall be considered to be reinforcing steel in vertical columns. Make connection to building steel with chemical weld type connector, in a location in unfinished space where the connection will not be subject to physical abuse.
6. Grounding Electrode connections to structural steel, reinforcing bars, ground rods, or where indicated on the drawings shall be with chemical exothermic weld connection devices recommended for the particular connection type. Connections to piping shall be with U.L. listed mechanical ground clamps.
7. Bonding shall be in accordance with the National Electrical Code.
8. Install ground rods where indicated on the drawings with the top of the ground rods 12 inches below finished grade.

C. Equipment Grounding Conductor:

1. Grounding conductors for branch circuits are not shown on the drawings; however, grounding conductors shall be provided in all branch circuit raceways and cables. Grounding conductors shall be the same AWG size as branch circuit conductors for #10 and smaller.
2. Grounding conductors for feeders are typically indicated on the drawings and the raceway is sized to accommodate grounding conductor shown. Where grounding conductor size is not indicated on the drawings, conductor shall be in accordance with the equipment grounding conductor table of the National Electrical Code.
3. An equipment grounding conductor shall be installed in all flexible conduit installations. For branch circuits, grounding conductor shall be sized to match branch circuit conductors for #10 and smaller.
4. A feeder serving several panelboards shall have a continuous equipment grounding conductor which shall be connected to each related cabinet grounding bar.
5. The equipment grounding conductor shall be attached to equipment with bolt or sheet metal screw used for no other purpose. Where the equipment grounding conductor is stranded, attachment shall be made with lug attached to grounding conductor with crimping tool.
6. Bond all motors by drilling and tapping the bottom of the motor junction box and attaching the equipment grounding conductor to the box with a round head bolt used for no other purpose. Conductor attachment shall be through the use of lug attached to conductor with crimping tool.
7. Equipment grounding conductors shall terminate on panelboard, switchboard, or motor control center grounding bus only. Do not terminate on neutral bus. Provide a single terminal lug for each conductor. Conductor shall terminate in the same section as the phase conductors originate. Do not terminate neutral conductors on the ground bus or equipment grounding conductors on the neutral bus.

D. Other Grounding Requirements:

1. Each telephone backboard shall be provided with a No. 6 grounding conductor. When backboard is located in vicinity of electrical service equipment, the "point of grounding" of this conductor shall be the main cold water service with connections made ahead of any valves or joints. Remote backboards shall use building steel as "point of ground". Terminate conductor by stapling to backboard.
2. At each building expansion joint flexible copper bonding jumpers shall be attached to building structure by chemical weld process. Install bonding jumpers in concealed

locations that will not subject connections or jumpers to physical abuse. Install 100' on centers across expansion joints.

3. Bond all metal at pools or fountains to grounding electrode system per NEC requirements.

3.2 TESTING

A. Upon completion of the ground rod installation, the Contractor shall test the installation in accordance with the "Electrical System Tests" section of this Specification. Grounding resistance reading shall be taken before connection is made to the building cold water piping system. Ground resistance readings shall not be taken within forty-eight hours of rainfall. Results of ground resistance readings shall be forwarded, in writing, immediately to the Project Engineer.

B. If the resistance to ground exceeds 5 ohms, additional rods shall be driven and bonded together, until a reading of 5 ohms or less to ground is obtained. After completion of the grounding system, measure the system ground resistance with a "Megger Earth Tester". Submit directly to the Project Engineer two (2) copies of each test report certified by the testing technician and the electrical contractor.

C. All grounding electrode conductors and ground bus shall be measured by the Contractor for objectionable levels of current, and to detect any inadvertent connection of neutral to ground.

D. If the ground current exceeds 10% of the rating of the conductor ampacity, all devices on that feeder or circuit shall be rechecked for proper connection.

E. All grounding system connections shall be rechecked at final checkout for correct wiring termination methods and mechanical strength.

END OF SECTION 260526

SECTION 260533 - RACEWAY SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260000.

B. This Section covers the complete interior and exterior conduit and raceway systems.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Galvanized rigid steel conduit (GRC) shall be low carbon, hot-dipped zinc galvanized steel to meet U.L. 6 Standards, ANSI C80.1 and shall have NPT (ANSI B1.20.1) full cut threaded joints, galvanized after forming. IMC shall carry U. L. Label. Conduit with integral couplings may be utilized for 2.5 inch sizes and above provided it conforms to U. L. Safety Standard #514-B.

B. Intermediate metal conduit (IMC) shall be premium hardened steel conforming to ASTM-A568, hot galvanized with zinc chromate exterior with polymer sealcoat to meet U.L. 1242 and ANSI C80.6 standards. Interior to be finished with corrosion inhibiting organic coating. Both coatings shall conform to ANSI C80.6 requirements. IMC shall have NPT (ANSI B1.20.1) full cut threaded joints, galvanized after forming. Conduit with integral couplings may be utilized for 2.5 inch sizes and above provided it conforms to U. L. Safety Standard #514-B. IMC shall carry U. L. Label.

C. Electrical metallic tubing (EMT) shall be high grade mild ductile steel, hot galvanized exterior with a clear organic polymer topcoat to meet U.L. 797 Standards and ANSI C80.3. Interior to be finished with corrosion inhibiting clear organic coating. Conduit with integral set screw couplings may be utilized for 2.5 inch sizes and above provided it conforms to U. L. Safety Standard #514-B.

D. Plastic conduit (PVC) shall be schedule 40 PVC heavy wall type for 4" and smaller, Schedule 20 for 5" and larger. PVC shall be U.L. Listed, NEMA TC 2, sunlight resistant and suitable for use with 90 degree C conductors.

E. Flexible metal conduit (FLX) shall be extra flexible, extra strength galvanized steel conduit tubing and shall meet U. L. Standard for Flexible Steel Conduit and U.L. Standard for Safety #1. The use of aluminum flexible conduit is not permitted.

F. Liquid-tight flexible metal conduit (WFX) shall be UL Listed with galvanized steel core of square locked or interlocked design, integral ground conductor and thermoplastic PVC (polyvinyl chloride) cover. The use of aluminum core or non-metallic types is not permitted.

G. Electrical non-metallic tubing (ENT) shall be UL Listed and manufactured to the requirements of NEMA TC-13. This raceway is permitted to be utilized with concrete encasement or unexposed installations only. Do not install exposed in plenums or other open areas. Utilize steel outlet boxes in all partition construction. Utilize plastic boxes only in concrete encasement.

H. Steel conduit approved manufacturers are Allied, Superior Essex, Republic, Wheatland and Pittsburgh.

I. Flexible conduit approved manufacturers are Anamet (Anaconda) and Republic.

J. PVC conduit approved manufacturers are Carlon and Superior Essex.

K. PVC coated metallic conduit approved manufacturers are Robroy, Permacote and Thomas & Betts.

2.2 CONDUIT FITTINGS

A. GRC and IMC conduit fittings shall be zinc-coated, ferrous metal and taper threaded type, U. L. Labeled.

B. EMT fittings shall be zinc-coated steel and shall be Type 1 or 2 (raintight compression or concrete tight set-screw type). EMT connectors shall have insulated throats. Die cast, malleable iron or pressure cast material will not be accepted. Fittings shall bear U. L. Label. Two (2) inch and larger fittings shall be compression type or shall utilize dual set screws for each side of fitting.

C. PVC fittings, elbows and cement shall be NEMA TC3, produced by the same manufacturer. All joints shall be solvent welded in accordance with the manufacturer's recommendations.

D. Conduit connections to switchboards, motor control centers, transformers, panels, cabinets, and pull boxes shall have locknuts designed to bite into the metal.

E. Each conduit end shall be provided with either an insulated throat connector or separate locknut and insulated bushing. Bushing shall be installed before any wire is pulled.

F. Expansion fittings shall be provided in all conduits which crosses an expansion joint in, across, or through same. Fittings shall be U.L. 467 and 514 Listed. Fittings shall contain an internal flexible metal braid to maintain system ground continuity.

G. Flexible conduit fittings shall be cast malleable iron or stamped steel type with integral fastener. Fittings shall be U.L. Listed for the application. The use of “squeeze” type cast or stamped steel connectors is not permitted.

H. Liquidtight flexible metal conduit fittings shall be liquidtight with neoprene bushing, nylon gland, tapered hub threads and outlet bushing. Fittings shall be U.L. Listed for the application. The use of non-metallic or thermo-plastic insert connectors is not permitted.

1. EMT conduit fittings approved manufacturers are Raco, Crouse-Hinds, O.Z Gedney, Thomas & Betts and Appleton.
2. GRC and IMC fittings approved manufacturers are Appleton, Cooper Crouse-Hinds, O.Z. Gedney or Thomas & Betts.

2.3 SMOKE AND FIRE STOP FITTINGS

A. If and where required, smoke and fire stop fittings shall be U.L. listed for that purpose. The fittings used to seal conduit either on the outside of the conduit or cable or internally shall have heat activated intumescent material which expands to fill all voids and shall be O.Z./Gedney "FIRE-

SEAL" or Dow Corning silicone RTV foam with an hourly fire-rating equal to or higher than the rating of the floor, ceiling or wall through which the cable or conduit passes. The seals for conduit shall be of the flanged type. Penetration of any fire rated wall, floor, or ceiling shall use Through-Penetration Firestop Systems described in the current Underwriters Laboratories Building Materials Directory.

2.4 RACEWAY SUPPORTS:

A. Raceways and systems shall be supported independent of any other equipment or appurtenances except the building structure. Suspended ceiling systems will not be considered as structure for support purposes, even if so rated by the manufacturer.

B. All support components shall be zinc-coated or have equivalent corrosion protection. Unprotected components shall be removed and replaced at no additional costs to the Owner.

C. Conduit support straps shall be single hole cast malleable iron or dual hole stamped steel type with zinc coating sized for type of raceway used. Conduit clamps for single conduit support shall be stamped steel with bolt & nut fastener and threaded rod support. Multiple conduit support channel straps shall be galvanized stamped steel two piece clamps with bolt & nut fasteners.

D. Conduit support channel shall be minimum 1 5/8” x 1 5/8” x 12 gauge roll formed pre-galvanized steel or painted steel conforming to ASTM A-570 Grade 33 or ASTM A-446 Grade A requirements. Channel cross section shall be increased to provide higher load bearing capability, if required by this installation. Channel shall have elongated holes at two (2) inch centers.

E. Drop wire type hangers will not be permitted. Any hanger which may distort the ceiling support structure will not be permitted. Lathers channel and chain are not acceptable for conduit hangers.

F. Furnish and install under this contract all angle iron, channel iron, rods, threaded rod, supports or hangers required to install or mount all electrical equipment, material or related devices. Conduit shall **not** be supported from steel decking, roof decking, bridging, ceiling or ceiling support wires.

G. Before any piping, conduit, outlets, equipment or lighting fixtures are located in any area, coordinate the space requirements with all trades. Such shall be arranged so that space conditions will allow all trades to install their work, and will also permit access for future maintenance and repair. Coordinate the installation of recessed electrical equipment with concealed ductwork, piping, insulation, structural appurtenances and wall thickness.

H. Support branch circuit conduits and raceways at intervals not exceeding ten (10) feet and within three (3) feet of each termination. Support feeder conduit and raceway at intervals not exceeding twelve (12) feet and within three (3) feet of each termination.

I. Piping, ductwork, conduit and equipment installed at variance with the above requirements shall be relocated and/or revised to conform with the above requirements without incurring additions to the Contract.

J. Raceway installed within reinforcing steel of elevated or slab on grade concrete construction shall be tied to the re-steel at intervals not exceeding three (3) feet.

2.5 SUPPORT FASTENER DEVICES

A. Anchors for post tensioned concrete applications shall be cast in place continuous or spot insert channel providing a safety factor of 3 in 3000 lb hard rock concrete.

B. Anchors for cast in place concrete shall be insert type expansion shields and bolts, lead shields and bolts or self drilling expansion shields and bolts. Powder actuated pins of 1500 pound pull out strength may be utilized in concrete.

C. Anchors for wood construction shall be lag bolts or power driven wood screws.

D. Anchors in hollow masonry shall be toggle bolts.

E. Anchors for steel attachment shall be machine screws, bolts, or beam clamps.

F. Equipment mounted to drywall construction shall be secured to power channel (13/16” x 1 5/8” minimum). Secure channel to a minimum of two (2) dry wall studs with drywall screws and washers.

G. Under no circumstance will nylon or composition type tie wraps or straps be permitted for use in supporting electrical raceway. Utilize galvanized tie wire or prefabricated steel clips for such support.

PART 3 - EXECUTION

3.1 CONDUIT

A. Rigid galvanized conduit or intermediate metal conduit shall be used for service entrance and all feeders and branch circuits where exposed to damage or moist conditions.

B. EMT shall be used for feeders, branch circuits, fire alarm and telephone when not underground or in concrete in contact with the earth. Raceway underground or in concrete in contact with the earth shall be rigid galvanized conduit, intermediate metal conduit or Schedule 40 PVC. Conduit exiting elevated slabs or slab on grade shall be IMC. PVC conduit exiting slab is not permitted.

C. Conduit shall be continuous from outlet to outlet, from outlet to cabinet, junction box and pull box. Conduit shall enter and be secured to all boxes, etc., in such a manner that each system will be electrically continuous from service to all outlets. All conduits from cabinets and junction boxes shall terminate in approved outlet box or conduit fittings. Conduit connections to any box which has no threaded hub shall have double locknuts and bushing installed.

D. Provide junction boxes or pull boxes where shown and where necessary to avoid excessively long runs or too many bends between outlets. The conduit sizes shown may be increased if desired to facilitate the pulling of cables.

E. All conduit shall be concealed unless indicated otherwise. Install exposed conduit parallel with or at right angles to the building walls and support from walls or ceilings at intervals required by Code with approved galvanized malleable iron or stamped steel clamps or hangers. Concealed conduit above the ceiling shall be supported independent of ceiling construction. Where ceilings of lay-in type are used, conduit must be installed minimum six (6) inches above ceiling structure to permit removal of ceiling panels and lighting fixtures.

F. Use threaded rods and hangers consisting of double-nutted threaded rods and channel or angles of 12 gauge minimum steel for supporting multiple conduits. Refer to drawing details.

G. Minimum size conduit for exposed branch circuits shall not be smaller than 1/2". Raceway installed in concrete slabs shall be minimum 3/4". Home runs shall extend from outlets shown to panel designated. Home runs shown shall not be combined. Home run conduit shall not be smaller than 3/4".

H. Type GRC and IMC conduit shall be cut and threaded with similar die heads. Deburr outside of all cuts prior to cutting threads. Cut threads one thread short so that they meet in the coupling and all threads are covered when wrench tight. Deburr inside of end after cutting threads. Right and left hand couplings shall not be used; conduit couplings of the Erikson Type shall be used at locations requiring such joints. Utilize only rigid type hand benders, "Chicago" type benders or power benders with required IMC shoes. DO NOT attempt to bend IMC with "hickey" type hand benders. Any such bends will be replaced at no additional costs to the Owner. Utilize only U.L. Listed conduit fittings, elbows and junction boxes (IMC or GRC types).

I. All conduit for future use and for special systems such as telephone, data or TV wire shall be left with No. 16 gauge wire or approved pull cord pulled in them.

J. Expansion fittings shall be installed in all conduit penetrations through, around or in expansion joints, and all straight runs in excess of 150 feet. Watertight flexible metallic conduit, connectors and couplings may be utilized for exposed transitions. U.L. 467 & 514 Listed fittings are required in slab.

K. Provide non-hardening elastic type duct seal compound, Neer No. DC, 3M Co. "Scotchfil," or Gardner Bender duct seal, for each conduit entering the building from outside, for each conduit entering refrigerated spaces, for each conduit entering exterior equipment and for each conduit passing from one space into another which is normally at a lower temperature. Conduits entering refrigerated spaces shall be IMC.

L. Provide intermediate metal conduit and watertight conduit hubs on conduit terminating in a box or cabinet exposed to the weather or damp locations.

M. Space in sleeves or around conduit that pass through fire resistive or fire rated walls, partitions, floors or ceilings shall be closed by packing with an U.L. labeled fire resistive material, or provide mechanical fire stop fittings that will maintain the rating of the barrier penetrated. Conform with local authority requirements and UL Building Materials Directory.

N. Coordinate the conduit routing and installation location with the actual electrical equipment furnished. Review submittals for termination locations. Coordinate with all Specification Divisions and submittals to determine termination and access locations. Coordinate installation sequence with all other trades to avoid conflicts and provide the fastest overall installation schedule.

O. Dented, malformed or flattened conduits are not permitted and shall be removed and replaced.

P. Protect conduits against dirt, plaster, and construction debris with the use of conduit plugs. Tape is not acceptable. Plugs shall remain in place until all masonry or/and drywall construction is complete. Protect conduit stub-ups during construction from damage, and replace any bent conduits.

Q. Conduits serving roof mounted equipment shall pass through roof curb where such is provided. Roof penetrations outside this equipment will not be permitted.

R. Separate raceway systems shall be provided for power systems and for control, signal and communications systems. Do not install above systems cables in the same raceway as branch circuit or feeder cables.

S. Service entrance and fire pump feeders shall be installed “Outside” of the building as defined by NFPA and the N.E.C. Provide concrete encasement where required to conform with Code requirements.

T. All conduits installed exposed shall be IMC to a minimum elevation of ten (10) feet AFF. Exposed boxes shall be type FS cast metal.

U. Where hazardous locations, as classified by the National Electrical Code, exist, all raceway and fittings and the installation of these materials shall comply with Article 500 requirements.

V. All conduits for interior wiring systems operating above 600 volts shall be galvanized rigid conduit, painted red at access points and labeled per OSHA requirements..

W. Maintain minimum three (3) inch clearance when raceway crosses piping and/or systems operating above 75˚F and provide twelve (12) inches separation when installed parallel to hot piping, flues or appliances operating above 75˚F.

X. Nonmetallic fittings shall be applied with compatible solvent welding cement and shall be fitted while solvent is liquid. Overwrap all fittings used in concrete encasement with suitable tape. Provide o-rings at terminal points to provide watertight seal.

3.2 FLEXIBLE CONDUIT

A. Watertight flexible metallic conduit shall be used in making short flexible connections to all motors, transformers, bus duct switches, kitchen equipment and rotating or vibrating machinery or equipment. The flexible conduit at these locations shall be as short as possible, but shall have a minimum length of 12". Flexible metallic conduit shall be used in making connections to heaters, fixed equipment or flush mounted light fixtures.

B. A green stranded bonding jumper shall be installed inside of all flexible conduit that extends directly from a non-flex conduit to a rotating or vibrating machine. Where a junction box is used, the green stranded bonding jumper shall be installed inside the flexible conduit and attached to the junction box and to the machine

3.3 CONDUIT PROTECTION

A. All threaded joints in galvanized rigid conduit that is encased in concrete shall have a U.L. listed joint compound applied. All conduit installed outside the building underground shall be buried a minimum of 30" below finished grade but in no case shall be buried deeper than 48". Where conduit inside building is installed below the floor slab, the vapor barrier shall be run below the conduit concrete encasement. Conduit installed in any slab, where permitted above, shall be above the bottom steel and below the top steel. No conduit shall be spaced less than 3" apart. Submit conduit layout to structural consultant for review and approval prior to rough-in.

B. Conduit shall be secured in place and protected where necessary to prevent damage to work during construction. The ends of all conduit shall be plugged with suitable caps (not tape) to avoid

filling with any foreign matter. All conduit shall be blown out and swabbed clear of water and trash prior to pulling wire.

C. Provide identifying marker tape the entire length of each conduit installed in the ground outside the building. The tape shall be constructed of inert polyethylene, resistant to acids, alkalis, etc., in the soil, and shall be a minimum 4 mil thickness. The tape shall be yellow, 6" wide, and shall have the words, "CAUTION - ELECTRIC LINE BURIED BELOW," imprinted with contrasting permanent ink. The imprint shall repeat itself for the entire length of the tape. The tape shall be buried at a maximum of 18" below finished grade, above a portion of the earth fill. Identify all underground and underslab conduit locations on as-built drawings for future reference.

D. Damaged, oxidized, warped or improperly stored raceway will be removed from the jobsite and replaced with new materials. Non-metallic conduit stored on site prior to installation shall be stored on a flat surface off the ground and shall be protected from direct sunlight and debris.

3.4 CORING, CUTTING AND PATCHING

A. Perform all coring, cutting and patching of existing walls and floors in order to install the work. Set sleeves for conduit accurately before the concrete floors are poured, or set boxes on the forms so as to leave openings in the floors in which the required sleeves can be subsequently located. Fill in the voids around the sleeves with concrete.

B. Should the performance of this preliminary work be neglected and should cutting be required in order to install conduit, then the expense of the cutting and restoring of surfaces to their original conditions shall be accomplished without incurring additions to the Contract.

3.5 BELOW GRADE RACEWAY INSTALLATION

A. Provide and perform all excavation required to install conduit, ductbanks and manholes indicated on the drawings and/or specified. Trenches shall be of uniform width required with minimum 8" clearance on both sides. Remove and dispose of all materials not to be used for backfill. Maintain dry excavations for electrical work, by removing water. Grade areas to prevent surface water from entering excavation. Remove any accumulated water by pumping. Perform all excavation by open cut. Excavate with vertical-sided excavations where possible. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition. Establish requirements for trench shoring and bracing to comply with local codes and LAHJ. No tunneling shall be permitted.

B. The bottom of all trenches and excavation shall be graded to provide uniform bearing surface for conduits or ductbanks on undisturbed soil at every point along entire length. Tamp over excavation with specified backfill materials. Remove unstable materials unsuitable for supporting equipment or installation and replace with specified materials for a minimum of twelve (12) inches below invert of equipment or installation.

C. Specified materials shall be utilized for backfilling, in not more than six (6) inch layers and tamped until the installation has cover of not less than the adjacent grade and not more than two (2) inches above same. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger the work or other property. Equalize backfilling operation to avoid shifting of materials and equipment installed. Compaction of backfill materials shall be at least equal to surrounding undisturbed material. Backfill trenches with concrete where

excavations pass within 18" of footings or other utility lines. Do not settle backfill with water. Conform to compaction requirements and methods specified elsewhere.

D. Concrete encased underground ductbanks shall be installed where indicated on the drawings. Ductbank conduits shall be non-metallic type EB, thin wall PVC with concrete encasement.

1. Stagger couplings of adjacent conduit runs by a minimum of two (2) feet. Provide pre-fabricated conduit supports installed per manufacturer's recommendation. Anchor ductbank assembly in trench to avoid "floating" during concrete pour.
2. Changes in direction shall be made by the installation of long sweep bends of minimum twenty-five (25) foot radius. All 90 degree ells shall be long sweep type of minimum twenty-four (24) inch radius.
3. Below all paving and traffic areas, all ductbank shall be reinforced with the installation of No. 5 rebar six (6) inches on center at each corner and on all sides, parallel to duct, and with continuous No. 3 rebar perpendicular to duct on sixteen (16) inch centers. Concrete cover for reinforced ductbanks shall be minimum six (6) inches with at least three (3) inches above rebar. Reinforcing of duct bank shall continue at least ten (10) feet to each side of required areas.
4. All ductbanks shall be sloped to drain toward manholes and shall be laid with minimum grade of four (4) inches per hundred feet.

END OF SECTION 260533

SECTION 260534 - BOXES AND FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260000.

B. This Section covers the installation of all outlet boxes, pull boxes, junction boxes and wiring troughs or other boxes throughout the wiring system, including supports.

C. Outlets are located diagrammatically on the drawings. Outlets shall be located so as to be symmetrical with Architectural details.

PART 2 - PRODUCTS

2.1 GENERAL MATERIAL REQUIREMENTS

A. All boxes shall be U. L. Listed and labeled.

B. Boxes shall be of one-piece construction, fabricated from NEC gauge galvanized steel, unless rustproof cast metal boxes are specified or required by NEC, or unless otherwise shown on the drawings.

2.2 OUTLETS

A. Outlet boxes and covers shall be of such form and dimensions as to be adapted to their specified usage, locations, size and quantity of conduit, and size and quantity of conductors entering the boxes.

B. Outlet boxes for typical applications shall be four inch square boxes 1 1/2” deep, with blank cover. For light fixtures, install adjacent to fixture served. Connection to fixture shall be with flexible steel conduit and fixture wire.

C. Junction boxes for branch circuit homeruns shall be minimum four inch square and 2-1/8” deep.

D. Flush ceiling outlets for surface or pendant mounted lighting fixtures shall be one-piece 4" square or octagonal pressed steel boxes, minimum two (2) inch depth.

E. Boxes for devices in unfinished masonry walls or stud walls shall be 4" square boxes with a square cornered tile wall cover (plaster ring), set flush with masonry or drywall construction. Where only one conduit enters box or one wiring device is provided, 2 3/4” deep box may be used. Outlet boxes for dimmers, GFI outlets, and all other conditions shall be full depth. Use multigang boxes where more than one device is mounted together under common coverplate. Do not use sectional switch boxes.

F. Boxes in concrete ceiling slab shall be octagonal, concrete-tight two (2) inch deep concrete boxes. Welded boxes are not acceptable.

G. All outlet boxes in plaster, drywall, stucco or masonry walls or ceiling shall be provided with plaster rings.

H. Junction boxes and all outlets not indicated as containing wiring devices or lighting fixtures shall have covers. Covers for outlets in walls shall be as specified for wall switches and receptacles.

I. Outlet boxes exposed to the weather, under raised floor, used in exterior wiring system and outlet boxes for vaportight lighting fixtures and devices shall be of cast corrosion resistant type.

J. In special "Fire Rated" partitions, outlets shall comply with ASTM No. E119 and maintain fire barrier ratings.

K. Utility (handy) boxes with matching covers may be used in mechanical and electrical spaces for switches and 15A/120V receptacles.

L. Where special purpose devices are utilized and require larger outlet box than specified herein, provide outlet box suitable for specific device. These outlet boxes shall be of the same type as specified herein for the installation required. Coordinate requirements prior to rough-in installation.

2.3 JUNCTION AND PULL BOXES

A. Dimensions of pull boxes and junction boxes shall not be less than those dimensions required by the National Electrical Code (NEC) article 314.28 for the number, size and position of conductors and raceway entering the box. Only a single extension ring shall be permitted on a box to increase the volume.

B. Pull boxes required in finished spaces shall be installed out of sight lines and located per Architect’s direction. Box shall be flush mounted cabinets provided with trim, hinged door and flush latch and lock to match panel trim for flush mounted electrical panelboard.

C. Pull boxes for installation of vertical riser conductors shall be provided with red seal type VVC or approved supports for all conductors as required by the NEC.

D. Pull boxes for horizontal feeders containing more than one feeder (not including parallel conductors) shall be provided with reinforced flange shall be compartmented by barriers (or feeder conductors shall be fire-taped) and provided with minimum 1 5/8” x 1 5/8” fiberglass channel strut (removable) for support of conductors. Wood supports within pull boxes are not acceptable.

E. Provide box covers for all junction and pull boxes of same materials and construction as box. Identify feeder or branch circuit conductors contained within on outside of cover for surface mounted boxes and within cover on flush mounted boxes.

2.4 EXTERIOR PULL BOXES & HANDHOLES

A. Exterior pull boxes shall be Quazite “PC” style Gasketed boxes, resistant to sunlight exposure, weathering and chemicals, with solid base, penta-head security bolts, heavy duty rated cover with logo to suit purpose, with compressive strength of 11,000 psi, or approved equal. Size

shall be minimum 12”w x 18”d x 12”h unless noted otherwise. Set assembly at final finished grade elevation.

B. Exterior handholes shall be Quazite “PG” style stackable service box assemblies resistant to sunlight exposure, weathering and chemicals, with solid base, penta-head security bolts, heavy duty rated cover with logo to suit purpose, with compressive strength of 11,000 psi, or approved equal. Size shall be minimum 24”w x 36”d x 18”h unless noted otherwise. Provide extensions as required to bring assembly to final finished grade elevation.

2.5 CONDUIT BODIES & FITTINGS

A. Conduit bodies and fittings shall be NEMA FB-1 zinc coated steel or malleable iron, taper threaded type, of material matching conduit type with gasketed cover containing captive screws.

2.6 WIRING TROUGH

A. Wiring trough shall be NEMA 1, unless noted otherwise, hinged cover with captive screws, grey enamel finished inside and outside, 16 or 14 gauge steel as per NEC requirements. Size of trough based on NEC requirements.

2.7 PULL BOXES & ENCLOSURES

A. Pull boxes for feeder and power conductors shall be NEMA 1 with 14 or 12 gauge galvanized steel bodies and 12 or 10 gauge galvanized steel screw covers. Seams shall be continuously welded and ground smooth. Cover screws shall be captive, stainless steel type. Provide oil-resistant gasket and adhesive. Size pullboxes as specified.

B. Enclosures for termination of special systems wiring shall be NEMA 1 panel enclosures with 14 gauge steel bodies and removable hinged doors. Provide back panel of 14 gauge steel construction and wiring terminal blocks. Enclosures shall be painted ANSI 61 and panels shall be white enamel. Size enclosures for quantity of terminations required plus 25% spare capacity.

2.8 ACCEPTABLE MANUFACTURERS

A. Outlet boxes:

1. Thomas & Betts
2. Hubble/RACO
3. Cooper Crouse-Hinds
4. Appleton

B. Floor boxes:

1. Thomas & Betts
2. The Wiremold Company
3. Hubbell
4. American Electric

C. Poke-through devices:

1. Hubbell
2. The Wiremold Company
3. Thomas & Betts

D. Exterior junction boxes & handholes:

1. Hubbell - Quazite
2. Appleton
3. Hubbell - Killark

E. Conduit bodies & fittings:

1. Adalet-PLM
2. Myers
3. O-Z Gedney
4. Appleton
5. Cooper Crouse-Hinds

F. Wiring troughs:

1. Rittal Corporation
2. Square D
3. Hoffman
4. Hubbell - Wiegmann

G. Pull boxes & enclosures:

1. Hoffman
2. Rittal Corporation
3. Hubbell - Wiegmann
4. American Electric
5. Cooper Crouse-Hinds
6. Schneider Electric

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide galvanized steel or cast type boxes for all outlets, and for junction or pull boxes. All boxes shall be accessible and sized per NEC requirements. Provide access panels in any non-accessible spaces to allow access to boxes installed.

B. Provide an UL listed outlet box for each ceiling mounted fan assembly shown.

C. Where outlet boxes are used to support lighting fixtures, as junction boxes, or device outlet boxes, the box shall be anchored to the structural members of the building per NEC 314.27.

D. Outlet boxes shall be flush mounted unless they are specifically shown as being used with exposed conduit or are located above a ceiling.

E. Where outlets are supplied from conduit run in or below floor slabs, the conduit shall be stubbed up at the location shown and the wall built up around the conduit.

F. Cuts for outlet boxes in masonry walls shall be made so that the coverplate will completely cover the cut. The mounting height of switch, receptacle and other outlets may be varied slightly, with the Architect's approval, so that the outlet box, top or bottom, will occur at a masonry joint.

G. The edge of all outlet boxes shall be flush with the surface in which they are recessed. The devices that fit into the outlet boxes shall be screwed tight before the cover plate is installed and the coverplate shall not be used as a means of tightening the devices in place. Provide box extensions as required to permit the above. Coordinate fabric panels, finishes and woodwork provisions in order to determine exact requirements.

H. Where outlets are shown as being adjacent and different mounting heights are specified for each, they shall be mounted one directly over the other, on the centerline of the group.

I. Electrical outlet boxes may be installed in vertical fire resistive assemblies classified as fire/smoke and smoke partitions without affecting the fire classification, provided such openings occur on one side only in each framing space and that openings do not exceed sixteen square inches. All clearances between such outlet boxes and the gypsum board shall be completely filled with joint compound or approved fire-resistive compound. The wall shall be built around outlet boxes larger than sixteen square inches so as not to interfere with the wall rating.

J. Where low voltage device is to be installed in common boxes with line voltage device (or devices of different operating voltage), provide insulated barrier within boxes to establish separate compartments.

K. Remove only knockouts required and plug all unused openings per NEC 314.17(A)/312.5(A) requirements.

L. Extend branch circuit grounding conductor to each box. Provide grounding pigtail via dedicated fastener.

M. Outlet boxes in the same wall shall not be mounted back-to-back but shall be offset a minimum of six (6) inches, except in acoustical rated walls where 24” is required.

N. Install pull boxes only in unfinished spaces or concealed above accessible ceilings. Provide pull boxes when any of the following conditions apply:

1. Where indicated on the drawings.
2. Where conduit run exceeds 150 feet from access point to access point.
3. Where conduit run contains in excess of 360 degrees bend or offset.
4. To facilitate conductor installation or to insure that manufacturer’s maximum pulling tension is not exceeded.
5. Where requirements of the special system or telephone installer/vendor dictate raceway access or provisions.

O. Do not splice conductors in pull boxes. Splices are not permitted in pull boxes except where specifically approved in writing by the Engineer. Where splices are permitted, make splices as specified in Wire & Cable Specifications.

P. Where pull boxes are required, multiple circuits within pull box shall:

1. Circuit conductors and feeders shall be individually laced with nylon straps and nylon identification tabs. Conduits shall enter pull box in such manner that conduits enter and exit in the same plane (both horizontal and vertical).
2. Feeder circuits shall be separated by full height and length sheet metal (NEC gage) or polyester resin barrier secured with angle brackets.

Q. Where exterior junction or pull boxes are required, install in the following manner:

1. Exterior junction or pull boxes shall be mounted flush with finished grade, unless noted otherwise. Coordinate with the final grade elevation.
2. Heavy traffic rated covers shall be provided in sidewalks, paved areas or within six (6) feet of same.
3. Seal conduit entries into boxes with duct seal to prevent entrance of water, after conductors are installed.
4. Taps and splices, where permitted by these specifications, shall be performed with an encapsulating watertight connection kit which insulates and moisture seals the connection.

R. After completion, clean all work of dirt, construction debris, paint and refuse.

3.2 COVERS

A. All junction boxes, outlet boxes, multi-gang switch boxes, utility boxes, etc., shall be covered with a coverplate. The coverplate shall be a finished plate as specified elsewhere unless designated otherwise.

B. Coverplates shall be mounted vertically unless designated otherwise.

C. Permanently mark each junction box and pull box cover with the circuit numbers for all conductors contained within. Utilize indelible ink black marker for normal power and red marker for emergency power and fire alarm.

D. All junction boxes and pull boxes for wiring systems above 600 volts shall be painted red and identified with high voltage warning labels in accordance with OSHA standards. Raceway shall be identified with the same labels installed every twenty (20) linear feet.

3.3 EQUIPMENT ANCHORING

A. Support all boxes from structure:

1. Secure to wood with wood or sheet metal screws.
2. Secure to hollow masonry with toggle bolts.
3. Secure to light gage metal with sheet metal screws.
4. Secure to heavy gage metal with bolts or clamps.
5. Anchors for solid masonry and concrete shall be self-drilling or insert expansion shields with bolts or powder actuated drive pin studs (except in post-tension construction).
6. Secure outlet boxes to dry wall studs with steel mounting bracket screwed into stud having support leg to restrain box.
7. Where box is suspended below structure, support from structure with threaded steel rod secured with double nuts. Pull boxes larger than 18” x 18” x 8” shall be supported from power strut and threaded steel rod suspension. Provide seismic bracing where required by local authority.

B. All items of electrical equipment, such as enclosures, panels, troughs, pull boxes, etc., shall be securely anchored to the building structure. The anchoring shall be accomplished by utilizing a minimum size of 3/8" steel anchor bolts in the structure and to the item of equipment. A minimum of two (2) anchor bolts shall be provided on each side of each item of equipment with the following exceptions:

Exception No. 1: If the equipment manufacturer includes more than two (2) anchor holes per side in the base or base frame of the equipment item, then there shall be one anchor for each anchor hole.

Exception No. 2: If the equipment manufacturer recommends a particular quantity greater than two (2) per side, then that quantity of anchors shall be provided.

END OF SECTION 260534

SECTION 260548 - NOISE AND VIBRATION CONTROL

PART 1 – GENERAL

1.1 DESCRIPTION

A. All work in this section shall comply with the provisions of Section 260000.

B. The Contractor shall install electrical equipment in a manner that prevents transmission of objectionable vibration into the structure. This isolation shall include resilient mounting of transformers, dimmer racks, conduit, motor starters, remote fluorescent fixture ballast cabinets and variable frequency motor controllers.

1.2 SUBMITTALS

A. Submit NEMA sound power ratings for all transformers.

B. Submit shop drawings for conduit passing through isolated block-outs in structure.

C. Variable frequency controller manufacturer shall submit a certification that the controllers are compatible with the motors to be used on this project.

1.3 STANDARDS

A. NEMA ST 20-1986; Dry Type Transformers for General Applications.

PART 2 – PRODUCTS

2.1 FLEXIBLE STEEL CONDUIT

A. Flexible steel conduit shall be UL-listed liquid tight flexible metal conduit as manufactured by American Brass, Columbia or approved equal. Fittings shall be single or double set screw type as manufactured by Appleton, Kellum or approved equal.

B. Flexible conduit connectors for conduit sizes greater than 2 inches diameter shall be Crouse-Hinds type XD expansion/deflection coupling, or approved equal.

2.2 NEOPRENE VIBRATION ISOLATORS

A. Neoprene floor mount isolators shall be Mason Industries type ND, or Kinetics type RD double deflection neoprene mounts, 50 durometer maximum, with 0.2 inch minimum static deflection under actual load.

B. Neoprene floor pads shall be Mason Industries type “Super W” 50 durometer maximum, with 0.15 minimum deflection under actual load.

C. Neoprene wall mount isolators shall be Mason Industries type BRA, RBA, or RCA, or Kinetics type RQ, 50 durometer maximum, with 0.05 inch minimum static deflection under actual shear load.

D. Submit manufacturer's catalog sheet for all neoprene mounts clearly marked to show equipment tag and weight, mount type and size, actual isolator deflection and maximum rated load for every mount. Submittals based on rated load shall be rejected.

1. DRY TYPE TRANSFORMERS: Transformers shall conform to the sound level limits set forth in NEMA ST-20.
2. Fluorescent fixtures shall not be used in critical spaces (RC-20 or below). Fluorescent fixtures in sensitive spaces (RC-25 thru RC-30) shall have advance Mark-V ballasts only.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Flexible conduit shall be used for all connections to all equipment vibration isolated with springs or neoprene (transformers, dimmers, pumps, fans, chillers, boilers, etc.). Flexible conduit shall be a minimum of 25% greater length than the separation between the isolated equipment and the termination of rigid conduit. Install the flexible conduit to be slack and not to exceed the manufacturer's minimum recommended bending radius. For conduit sizes greater than 2 inches diameter, use pre-manufactured flexible conduit connectors instead of flexible conduit.

B. Mount all transformers, dimmer racks, remote fluorescent fixture ballast cabinets and variable frequency motor controllers on neoprene floor mount or wall mount isolators. There shall be no rigid connection between isolated equipment and structure.

C. Flexible conduit or a flexible conduit connector shall be used at every location where conduit crosses a building expansion or isolation joint.

D. Conduit connected to vibration isolated electrical equipment shall be resiliently mounted to structure for a distance equal to 200 conduit diameters, and for any additional extent indicated on the Drawings.

E. Conduit passing through mechanical room walls, floors or ceilings shall be resiliently packed and sealed according to Division 23 requirements.

END OF SECTION 260548

SECTION 262100 - SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260000.

B. This section covers the Electrical service entrance requirements to the building from the power company transformer(s).

C. Electric service shall be obtained from the local Electrical Utility Company having jurisdiction.

D. Transformers pads, barriers, clearances and primary service shall be provided and installed as directed by the Electric Utility Company rules, regulations and installation guide.

E. Electric service shall be 208/120 Volts, 3 Phase, 4 Wire, Wye connected, Ampacity as indicated on the plans.

F. Electrical Contractor shall make all arrangements with the Electric Utility that are necessary to obtain electrical service, both temporary and permanent.

G. Metering and current transformers shall be provided and installed as directed by the Electric Utility Company. This contractor shall make all provisions necessary for the installation of the Electric Utility metering equipment in accordance with utility company.

H. Electrical Contractor shall make all arrangements for temporary electrical service to the site during the construction phase and maintain electric service to existing facilities as required.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE CABLES

A. Install service entrance cables as shown on drawings and as specified herein.

B. All materials and methods of construction for service provisions shall comply with the Electric Utility Company requirements.

C. Provide 4” PVC primary conduit from the utility demarcation point to the primary side of the power company transformer. Coordinate routing with the power company representative.

PART 3 - DISTRIBUTION

3.1 INSTALLATION

A. Obtain all necessary standards and detail drawings from the Electric Utility Company before building construction or excavation adjacent to service equipment is started.

B. Coordinate service and connections with the Electric Utility.

C. Make arrangements with the Owner and the Electric Utility Company to install, terminate, relocate, or transfer primary electric service without disruption of the normal operation of the Owner's business, or any other electric services (eg. adjacent tenants...etc.) as required. Installation cost of the electric service should included provision for the work of both the electrical contractor and utility company (if so required) for non-normal work hours (eg. nighttime or weekend...etc.).

END OF SECTION 262100

SECTION 262413 - SWITCHGEAR & SWITCHBOARDS

PART 1 - GENERAL

1.1 SCOPE

A. All work specified in this Section shall comply with the provisions of Section 260000.

B. This section covers the installation and provision of the Main Switchboard and associated equipment.

1.2 DESCRIPTION

A. All distribution switchgear (branch circuit panelboards, switchboard, distribution panelboards, (busway) shall be the unit responsibility of one manufacturer. All component parts of the above listed items shall be of the same manufacturer.

B. Shop drawings for equipment specified in this Section shall show that all specified requirements have been incorporated. Shop drawings shall include a scaled drawing for each piece of equipment showing elevation and floor plan of layout in each electrical room.

1.3 METERING

A. Metering equipment for the service entrance will be provided by the Power Company. Coordinate with the power company to receive current transformers for installation by switchboard manufacturer in a separately barrier compartment in the incoming section of the switchboard.

1.4 QUALITY ASSURANCE

A. Reference Standards:

1. Section Cross Reference: Refer to Division 01, Submittals for general requirements.
2. Underwriter's Laboratories Inc. (U.L.) – standard 891 for switchboards, standard 489 for circuit breakers.
3. National Fire Protection Association (NFPA): - NFPA 70, 2011.
4. National Electrical Manufacturers Association - NEMA.
5. Institute of Electrical and Electronic Engineers - IEEE.
6. American Society of Testing and Materials - ASTM.
7. ANSI C37.20.1 - Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear.
8. ANSI C37.51 - Testing of Metal-Enclosed Low-Voltage AC Power Circuit Breaker Switchgear.
9. NEMA SG-510. ANSI Z55.1 - Gray Finishes for Industrial Apparatus and Equipment.
10. ANSI/IEEE C57.13 - Requirements for Instrument Transformers.

PART 2 - PRODUCTS

2.1 MAIN SWITCHBOARD

A. Provide where indicated a front-accessible dead front type, completely metal enclosed, self-supporting structure independent of wall supports. It shall consist of the required number of vertical sections bolted together to form one rigid switchboard incorporating switching and protective devices of the number, ratings and type noted herein or shown with necessary interconnections, instrumentation and control wiring. Provide a voltmeter and ammeter on the main breaker with phase selector switches and required potential and current transformers. The sides, top and rear shall be covered with removable screw-on plates. Front plates shall be sectionalized and removable. All covers shall be secured by self tapping screws. Ventilation openings shall be provided where required.

1. The feeder or branch device shall be removable from the front and shall be panel mounted with the necessary device line and load connections front accessible.
2. All exterior and interior steel surfaces of the switchboard shall be cleaned and finished with gray hard dried enamel over a rust-inhibiting phosphatized coating.
3. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished when required. All groups of control wires leaving the switchboard shall be provided with terminal blocks with numbering strips.

B. The buss shall be copper adequately braced and supported to withstand mechanical forces exerted during short circuit conditions. The main horizontal bus bars shall be mounted on glass polyester insulators with all three phases arranged in the same vertical plane. The main bus shall be braced for short circuits up to 65,000 amps RMS, or larger as indicated on schedule.

C. A ground bus shall be provided firmly secured to each vertical structure and shall extend the entire length of the switchboard. A ground lug shall be furnished attached to the ground bus in an accessible location.

D. Electrical circuits shall be protected by molded cased circuit breakers. Each pole shall provide inverse time delay and instantaneous circuit protection

E. Circuit breakers shall be operated by a toggle type handle and shall have a quick-make, quick-break overcenter switching mechanism that is mechanically trip-free from the handle so that the contacts cannot be held closed against short circuits and abnormal circuits. Tripping due to overload or short circuit shall be indicated by the handle's automatically assuming a position midway between the manual ON and OFF positions.

F. Breakers must be completely enclosed in a molded case. Non-interchangeable trip breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible. Contacts shall be of the non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes.

G. All circuit breakers with frame sizes 600 amps and larger shall have solid state trip units that are insensitive to changes in ambient temperature and a push-to-trip button to mechanically check the trip mechanism or for the use under emergency trip conditions. Inter-changeable rating plugs shall establish the continuous current rating of each breaker. An interlock in the rating plug shall trip the breaker if an attempt is made to remove the plug with the breaker in the ON position. With the plug removed, it shall not be possible to close the breaker.

H. The solid state trip breakers shall provide long delay and magnetic tripping similar to thermal magnetic breakers. In addition, the magnetic trip shall include a short time delay permitting coordination and selective tripping with down-stream devices. It shall be possible to check the

breaker electrically and mechanically while in service without dismantling equipment and with minimum down time.

I. Breakers 1000 amps and larger shall be provided with integral ground fault protection. They shall have an adjustable ground fault pickup, ground fault delay, zero sequence ground fault sensing and integral ground fault test button and indicator.

J. Provide Zone Selective Interlock system for all breakers rated at, or capable of being adjusted to, 1200 amps or greater, in accordance with NEC 240.87.

K. Utilize two-bolt compression type lugs throughout, in lieu of mechanical type.

L. The switchboard as a complete unit shall be given a single short circuit current rating by the manufacturer of the rating shown on the drawings. Such a rating shall be established by actual test in accordance with U.L. specifications. Unit shall be listed for use as service entrance equipment and shall utilize breakers rated for 100% duty.

M. Acceptable manufacturers are ABB (GE), Schneider Electric (Square D), Siemens or Eaton Electrical.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide all necessary hardware to level and secure the switchgear as required by the manufacturer's instructions. Make all electrical connections for supply and load circuits and leave in operating condition.

B. Clean enclosure of all switchgear of all foreign matter, including dust.

C. All floor mounted distribution equipment shall be mounted on a 4" high concrete pad.

D. The manufacturer shall provide ground fault studies and shall provide settings for all ground fault protection equipment.

E. Contractor shall provide short circuit coordination study, including recommended settings for all adjustable devices.

END OF SECTION 262413

SECTION 262415 - DISTRIBUTION PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260000.

B. This section covers circuit breaker type distribution panelboards.

PART 2 – PRODUCTS

2.1 DISTRIBUTION PANELBOARDS

A. Distribution panelboards shall be of the circuit breaker type, factory assembled by the manufacturer of the circuit breakers. Flush mounted units shall have front door cover. The main breaker and the branch circuit breakers shall be as indicated. The main bus shall be copper and rated of capacity equal to or greater than the rating or setting of the over-current protective device next back in the line. Panel shall be suitable for the voltage and phase indicated.

B. Panels shall be flush or surface mounted as indicated, with baked-on enamel trim, adjustable trim clamps and door with corrosion resistant cylinder lock and catch and nameplate for each device and a blank (not engraved) nameplate for each spare breaker or space.

C. The neutral bus shall have 100% rating and utilize set-screws to bond the neutral bus through hoes drilled into the neutral bar. A sheet copper neutral bus utilizing flathead screws to hold the neutral wires will not be acceptable. Ground bus shall be sized per U.L. standards.

D. All circuit breakers shall be molded case, manually operated, thermal-magnetic, automatic, of the ampacity and poles as indicated. They shall be quick-make, quick-break both on manual and on automatic operation. Breakers shall be over-the-center toggle operating type, with the handle going to a position between "ON" and "OFF" to indicate automatic tripping. All multi-pole breakers shall have internal common trip.

E. The interrupting capacity of the breakers furnished shall be as indicated on plans.

F. All circuit breakers, including any connector to the main bus, shall be bolted on or plug-in type.

G. Spaces for future installation of molded case circuit breakers are specified by range of trip rather than a single trip size or frame size. The spaces so scheduled shall be complete with all bus and required bus connectors such that future breakers can be installed without adding or changing bus connectors on the main bus and without using a larger (frame size) or more expensive breaker than the trip size and interrupting capacity would require. If the bus connectors furnished on the main bus will not cover the trip range specified, then duplicate sets of connectors shall be furnished on the main bus for each frame size required.

H. Provide Zone Selective Interlock system for all breakers rated at, or capable of being adjusted to, 1200 amps or greater, in accordance with NEC 240.87.

I. Provide ground fault protection for any breaker serving panels with kitchen equipment or elevator motors.

J. Acceptable manufacturers are ABB (GE), Schneider Electric (Square D), Eaton Electrical or Siemens.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide a typewritten directory under plastic for all panelboards with spares left blank.

B. Provide all necessary hardware to secure panelboards to structure as required by the manufacturer's instructions. Make all electrical connections for supply and load circuits and leave in operating condition.

C. Clean enclosure of all panelboards of all foreign matter, including dust.

D. Bond separate ground bars to panelboard boxes and to the main service entrance ground bus with a code-sized grounding conductor installed in the same conduit as the phase and neutral conductors.

E. Provide six circuit breaker handle lock-on devices for each lighting panelboard for circuits as directed by the Project Engineer to prevent unauthorized personnel from turning off circuits to controls, unit heaters, clocks, night lights, etc. Turn spare lock-on devices over to the Owner for his use.

END OF SECTION 262415

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260000.

B. This section covers lighting and appliance panelboards and load centers.

PART 2 - PRODUCTS

2.1 PANELBOARDS

A. Panelboards (panels) shall be general purpose enclosures and shall be surface or flush mounted as indicated. Panels shall be of the automatic circuit breaker type, factory assembled by the manufacturer of the circuit breakers. Panels shall be for the voltage indicated with the quantity of poles and ampacity of circuit breakers shown.

B. Boxes and trim shall be made from code gauge steel. Boxes shall be of sufficient size to provide a minimum gutter space of 4" on all sides. Boxes shall be minimum 20" width and 5-3/4" depth.

C. Hinged door covering all device handles shall be included in all panel trim. Doors shall have flush-type cylinder lock and catch, except that doors over 48" in height shall have auxiliary fasteners at top and bottom of door in addition to flush-type cylinder lock and catch. Door hinges shall be concealed. All locks shall be keyed alike. Directory frame and card having a transparent cover shall be furnished with each panel door.

D. Trims for flush panels shall overlap the box by at least 3/4" all around. Surface trims shall have the same width and height as the box. Trims shall be mountable by a screwdriver without the need for special tools. After installation, trim mounting mechanism or hardware shall not be accessible when panel door is closed and locked.

E. All exterior and interior steel surfaces of the trim shall be cleaned and finished with gray paint over a rust-inhibiting phosphatized coating.

F. All interiors shall be completely factory assembled with protective devices, wire connectors, and shall be so designed that devices may be changed without machining, drilling or tapping.

G. Interiors shall be so designed that devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

H. Bus bars for the mains shall be of copper in accordance with U.L. Standards. Full size bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices.

I. Phase bussing shall be full height without reduction. Cross and center connectors shall be of the same material as the bus.

J. The neutral bus shall have 100% rating and utilize set-screws to bond the neutral wire to the neutral bus through holes drilled in the neutral bar. A sheet copper neutral bus utilizing flathead screws to hold the neutral wires will not be acceptable. Ground bus shall be sized in accordance with U.L. standards.

K. Spaces for future devices shall be molded case, included as indicated and shall be bussed for the maximum rated device that can be fitted into them.

L. All circuit breakers shall be manually operated, thermal-magnetic, automatic, of the ampacity and poles as indicated. They shall be quick-make, quick-break, on both manual and automatic operation. Breakers shall be over-the-center toggle operating type, with the handle going to a position between ON and OFF to indicate automatic tripping. All multi-pole breakers shall have internal common trip. Breakers shall have a minimum of 10,000 RMS symmetrical amperes interrupting capacity unless designated otherwise.

M. The breakers furnished shall be determined by the specifications and by the minimum U.L. labeled RMS symmetrical amperes interrupting capacity at circuit voltage. All circuit breakers shall be bolted on and rigidly braced.

N. Panels having sub-feed lugs for feeding through shall have 8" minimum extra gutter space at the lug end and on one side.

O. Each panel as a complete unit shall have a short-circuit current rating equal to or greater than the equipment rating indicated.

P. Acceptable manufacturers are ABB (GE), Schneider Electric (Square D), Siemens or Eaton Electrical.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide a typewritten directory under plastic for all panelboards with spares left blank.

B. Provide all necessary hardware to secure panelboards to structure as required by the manufacturer's instructions. Make all electrical connections for supply and load circuits and leave in operating condition.

C. Clean enclosure of all panelboards of all foreign matter, including dust.

D. Bond separate ground bars to panelboard boxes and to the main service entrance ground bus with a code-sized grounding conductor installed in the same conduit as the phase and neutral conductors.

E. Provide six circuit breaker handle lock-on devices for each lighting panelboard for circuits as directed by the Project Engineer to prevent unauthorized personnel from turning off circuits to controls, unit heaters, clocks, night lights, etc. Turn spare lock-on devices over to the Owner for his use.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260000.

B. This Section covers wiring devices and cover plates including receptacles, switches, dimmer controls, plugs, plug connectors, floor outlets, concealed service floor outlets and poke-through device assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURED WIRING DEVICES

A. Provide manufactured wiring devices and cover plates, in types, colors, and electrical ratings for applications indicated and complying with NEMA Standard WD 1. Where types and grades are not indicated, provide specification grade selection as determined to fulfill wiring requirements, and complying with NEC and NEMA standards for wiring devices. Provide white color devices and cover plates except as noted otherwise. Color selection shall be verified with the Architect prior to purchase and installation.

B. The devices specified herein are the products of one manufacturer. Provide heavy-duty specification grade devices selected from approved manufacturer listing.

2.2 WALL SWITCHES

A. Wall switches shall be Institutional, heavy-duty specification grade, plastic body, nylon or lexan toggle, totally enclosed base & cover, quiet type, self-grounding, back wired, 277 volts AC and 20A rating.

1. Single Pole: Leviton 5621 Series
2. Double Pole: Leviton 5622 Series
3. Three-way: Leviton 5623 Series

B. Flush motor switches shall have a red pilot light and overload protection for actual fractional horsepower motors furnished. Square D FSJ-1P or approved equal.

C. Wall mounted occupancy sensor switches shall be factory-set at the settings indicated on the drawings.

2.3 WALL DIMMERS

A. Wall dimmer switches shall be totally enclosed, solid state type, self-grounding, vertical slide type, thin-profile, semi-flush mounted, with square law dimming characteristics.

B. Dimmers shall be sized to continuously carry the indicated maximum loads shown and shall be rated to serve the load. Dimmers shall not require derating when gang mounted.

C. Where wiring devices are indicated adjacent to, and mounted with wall dimmers, provide wiring devices matching dimmer in appearance and by same manufacturer under common cover plate.

D. Dimmers indicated on the drawings to serve low voltage incandescent lamps shall be the same as specified for incandescent lamps and, in addition, shall be specifically rated for the low voltage (transformer or solid state type as required) loads. Dimmer shall be UL Listed for use with low voltage fixtures.

2.4 RECEPTACLES

A. Duplex receptacles shall be heavy-duty specification grade, plastic base, nylon face, two-pole, three wire, self-grounding, back/side wired, 125 volts AC and NEMA 5-15R (15A) or NEMA 5-20R (20A) rating as indicated on drawings.

1. Duplex NEMA 5-15R Hubbell CR5262
2. Duplex NEMA 5-20R Hubbell CR5362

B. Ground fault circuit interrupting (GFCI) duplex receptacles shall be heavy-duty, specification grade, plastic base, nylon face, two-pole, three wire, supplied with pre-stripped wire leads, feed-through protection, 125 volts AC and NEMA 5-15R (15A) or NEMA 5-20R (20A) rating as indicated on drawings.

1. Duplex GFCI NEMA 5-15R Hubbell GFR5262
2. Duplex GFCI NEMA 5-20R Hubbell GFR5362

C. Single receptacles shall be heavy-duty specification grade, plastic base, nylon face, two-pole, three wire, self-grounding, back/side wired, 125 volts AC and NEMA 5-20R (20A) rating.

1. Single NEMA 5-20R Hubbell 5361

D. Clock outlets shall be specification grade, plastic base, phenolic face, two-pole, three wire, side wired, stainless steel plate with recessed outlet, 125 volts AC and NEMA 5-15R (15A) rating.

1. Clock outlet NEMA 5-15R Hubbell 5235

E. All devices installed in dwelling units or guest rooms/suites shall be Tamper-Resistant devices in compliance with NEC 406.12 or 406.13, respectively.

F. Special purpose outlets shall be heavy-duty specification grade, plastic base, nylon face, poles as noted, wires as noted, grounding type, back/side wired, with voltage and capacity rating noted. Conform to NEMA configuration requirements.

G. Exterior flush mounted duplex outlets shall be GFCI heavy-duty, industrial specification grade, plastic base, nylon face, two-pole, three wire, supplied with pre-stripped wire leads, feed-through protection, 125 volts AC and NEMA 5-15R (15A) recessed mounted in TayMac gasketed enclosure model Masque 72206 or approved equal. Unit assembly shall protrude no more than 1/2” and shall be rainproof in use per NEC 406.9(B). Provide color as specified by the Architect.

2.5 COVERPLATES

A. Coverplates for flush mounted devices shall be one piece standard size high impact smooth nylon surface. Color shall match wiring device finishes. Device plates for masonry walls shall be jumbo type.

B. Telephone/data outlet coverplates shall be the same finish as above and have two (2) modular jack openings with blank fillers as required. All Computer Lab coverplates shall have four (4) modular jack openings.

C. Coverplates for flush mounted GFCI devices shall be premarked “GFCI PROTECTED”.

D. Coverplates for flush mounted IG devices shall be premarked “ISOLATED GROUND”.

E. Coverplates for flush mounted EMERGENCY POWER devices shall be premarked “EMERGENCY”.

F. Coverplates for flush mounted UPS POWER devices shall be premarked “COMPUTER ONLY”.

2.6 PLUGS & CONNECTORS

A. Plugs and connectors shall be of nylon construction, heavy duty specification grade, brass contacts and terminations, conforming to UL 94 & 498, with cord grips, 600 VAC working range, straight blade or locking type and NEMA type as noted.

2.7 FLOOR OUTLETS

A. Where installation of floor mounted device box requires penetration of a fire rated floor slab, the installation shall be made with a fire rated floor fitting, U. L. Listed for use in this specific fire rated floor design. Fire barrier shall be rated to prohibit passage of smoke when heat is not present.

B. If and where required, floor outlets shall be single gang floor boxes, Steel City No. 601 Series, complete with cast iron body, vertical angular adjustment, with brass frame, brass floorplate (#P60-CACP for duplex receptacle and #P60-3/4-2-CACP for phone/data) and gasket. Larger than standard tappings shall be furnished where required. Adjacent boxes shall be installed on minimum 7" centers.

2.8 POKE-THROUGH ASSEMBLIES

A. Flush poke-through fittings shall be U. L. Listed for fire rating, with retaining ring, suitable for use in three (3) inch core or insert, consisting of flush service fitting, poke-through device and outlet box. Fittings shall be U. L. Listed for dual service use (power and phone/data) in a single service fitting and shall have neoprene seals at base of fitting. Minimum spacing shall be two (2) feet between similar fittings. Specific fitting requirements shall be as specified on the drawings. Carpet flange with epoxy finish shall be provided.

2.9 ACCEPTABLE MANUFACTURERS

A. Wiring devices & cover plates:

1. Cooper Industries
2. Hubbell
3. Leviton
4. Pass & Seymour (Legrand)
5. Schneider Electric

B. Wall dimmers:

1. Lutron
2. Prescolite
3. Hunt Dimming
4. Lightolier

C. Plugs & connectors:

1. Cooper Industries
2. Hubbell
3. Leviton
4. Pass & Seymour

D. Floor outlets & concealed service floor outlets:

1. Thomas & Betts
2. Hubbell
3. The Wiremold Company

E. Poke through assemblies:

1. Thomas & Betts
2. Hubbell
3. The Wiremold Company

PART 3 - EXECUTION

3.1 STANDARDS COMPLIANCE

A. Installation and provision of all specified equipment shall be in accordance with:

1. National Electrical Code NFPA 70
2. Underwriters Laboratories (UL) UL 20, 498, 943
3. National Electrical Manufacturer’s Association (NEMA) NEMA STDS WD 1, 2, 5

3.2 INSTALLATION

A. Coordinate installation roughin requirements with architectural and structural features, equipment installed under other portions of these specifications, and electrical equipment.

B. Coordinate the installation of switches and wall dimmers with the door swings to insure that the devices are located on the strike side of the door.

C. Review the architectural and/or interiors drawings and elevations for devices requiring specific locations.

D. Coordinate access to poke-through assembly junction boxes such that these are readily accessible after completion of construction.

E. The mounting height of devices is indicated in the legend on the drawings and is intended to mean the bottom of the device above the finished floor unless otherwise noted.

F. Mount all devices within outlet boxes to allow device cover plates to be in contact with wall on all sides. Verify all outlet boxes in grouping are at the same elevation.

G. Install vertically mounted receptacles with the ground connection up.

H. Install switches with “Off” position down.

I. Provide neutral conductor for occupancy sensor switches.

3.3 WIRING DEVICES

A. Install wiring devices as indicated, in compliance with manufacturer’s written instructions, applicable requirements of NEC and NECA’s “Standard of Installation”, and in accordance with recognized standard industry practices to fulfill project requirements.

B. Where more than one wiring device is indicated at a location, the devices shall be gang-mounted in combined multi-gang boxes and covered jointly by a common coverplate. Provide barriers as required by the devices and voltages being used.

C. Install wiring devices only in electrical outlet boxes which are clean, free from construction debris, drywall compound and dirt. At final inspection all wiring devices shall be clean, free of paint overspray, unbroken and in new condition.

D. Ground all wiring devices by electrically continuous, pigtail connection such that removal of device does not open grounding path to any downstream device. Connect the grounding screw of each device to the equipment grounding conductor.

E. Prior to energizing circuits, test wiring system for electrical continuity, freedom from faults, and proper polarity of connections. After energizing circuits, test wiring devices to demonstrate compliance with these requirements.

F. Provide neutral conductor to all wall-mounted occupancy sensor switches.

3.4 COVERPLATES

A. All junction boxes, outlet boxes, multi-gang switch boxes, utility boxes, etc., shall be covered with a coverplate. The coverplate shall be a finished plate as specified unless designated otherwise.

B. Coverplates shall be mounted vertically unless designated otherwise.

C. Do not install cover plates until after painting and/or other finish work is complete.

D. Where the cover plate does not completely cover the wall opening, replace the plate with an oversized (midi or jumbo) plate or repair the wall opening. Where one oversize plate is used, replace all cover plates in the room with the oversize plates.

E. Remove concrete protectors and clean all floor boxes after concrete pour. Adjust boxes to be flush with finish floor elevation.

F. At final inspection, all wiring devices and cover plates shall be clean, without paint overspray, undamaged and unscratched or broken.

END OF SECTION 262726

SECTION 262816 - MOTOR AND FEEDER DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260000.

B. This Section covers disconnect switches for electrical equipment, 600 volts or less, and fuses mounted in the disconnect switches.

C. Furnish and install disconnect switches for the following conditions:

1. Where indicated on the drawings or schedules.
2. For all motor controllers unless installation conforms to exceptions in the NEC.
3. For all motors located out-of-sight of its motor controller.
4. For all transformers as required by NEC.
5. For all water heaters.
6. For electrical duct heaters.
7. Where required by the National Electrical Code.

1.2 QUALITY ASSURANCE

A. Industry Reference Standards:

1. Underwriters Laboratories Inc. Publications:
   UL 98 Enclosed Switches
   UL 198.2 High Interrupting Fuses, Current Limiting Type
   UL 198.4 Class R Fuses

2. National Fire Protection Association (NFPA):
   NFPA 70

3. National Electrical Manufacturers Association:
   KS-1 Enclosed Switches
   PUB 250 Enclosures for Electrical Equipment

4. American National Standards Institute:
   C97.1 Low Voltage Cartridge Fuses (600 v)

B. All equipment furnished shall be U.L. Listed and Labeled.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

A. Disconnect switches shall be "heavy-duty" type enclosed switches of quick-make, quick-break construction. Current carrying parts shall be copper, with silver tungsten type switch contacts and positive pressure type reinforced fuse clips. Switches shall be horsepower rated type HD where motor is served and rated for either 250 volt AC or 600 volt AC as required for voltages utilized. Size in accordance with the NEC. Lugs shall be UL listed for copper and aluminum cable.

B. Switches shall be furnished in NEMA 1 General Purpose enclosure unless noted otherwise. Switches located on the exterior of the building or in "wet" locations shall have NEMA 3R enclosures. When subject to splashing water, seepage of water, or falling or hose-directed water, switches shall be furnished in NEMA 4 enclosures. When located in an industrial plant subject to fibers, lint, dust, dirt, etc., switches shall be furnished in NEMA 12 enclosures.

C. Fused disconnect switches shall have rejection type fuse clips with dual element, current limiting fuses of rating shown.

D. Furnish a solid neutral bus or lug for each switch being installed in a circuit which contains a neutral conductor.

E. Furnish an equipment grounding conductor lug bonded to the switch enclosure by dedicated fastener.

F. Disconnect switches shall be non-fusible type safety switch, unless fused type is specified or indicated on the drawings, with the number of poles required to disconnect all ungrounded conductors serving equipment.

G. Provide multi-pole disconnect switches for all dual speed motors to disconnect all ungrounded conductors serving equipment.

H. Switches shall have the following features:

   a. Line terminal shields on line and load lugs.
   b. Padlocking provisions shall be provided for padlocking in the "Off" position.
   c. Each switch shall have defeatable door interlock mechanism to prevent door from being opened when switch is in closed position.
   d. Provide arc chute for each pole.
   e. Provide nameplate for each switch as previously specified.

I. Fusible switches through 600 ampere shall be provided with rejection clips to accept RK1 or RK5 fuses only. Fusible switches larger than 600 ampere shall be suitable for Class L fuses. Furnish and install a complete set of fuses in each disconnect switch sized as indicated on the drawings. Fuses serving predominantly motor or transformer loads shall be dual element, time-delay type, otherwise non-time delay type is required. Fuses shall be current limiting type.

2.2 ACCEPTABLE MANUFACTURERS

A. Acceptable disconnect switch manufacturers are:

   a. ABB (GE)
   b. Schneider Electric
   c. Eaton Electrical
   d. Siemens-Allis
   e. Rockwell Automation

f. Appleton Electric
g. Cooper Crouse-Hinds

B. Acceptable fuse manufacturers are:

a. Chase-Shawmut
b. Alstom

C. Equipment supplied under this section shall be the same manufacturer as the Service and Distribution Equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate disconnect switches to provide working clearance and full accessibility as required by the NEC.

B. Unless indicated otherwise on the drawings, locate disconnect switches adjacent to equipment served.

C. Provide power wiring to and install all disconnect switches and extend feeders to motors or other loads, unless integrally factory mounted on a piece of equipment.

D. Provide power wiring to all roof mounted equipment via roof curb openings provided. Do not penetrate roof membrane with conduit stubups.

E. Coordinate exact location of motor termination boxes with raceway roughin provisions to insure correct installation

F. Connect all heating and air conditioning equipment and have this equipment complete and ready for operation. Contractor shall be responsible for checking equipment manufacturer submittal data to obtain exact location of all electrical connections for equipment before installation.

G. A short section of watertight metallic flexible conduit shall be used at each motor connection.

H. Restore factory finish to all equipment provided herein and touch up scratched or marred surfaces to match original finish. Clean enclosure interior and exterior of dirt, paint, and construction debris.

I. Maintain conductor phase relationship originating at service entrance throughout motor control center. Group and strap all conductors installed in starter and wiring gutters with nylon straps. Install only one conductor under each terminal. Connect extra conductors via terminal strips. Form and train conductors neatly in enclosures parallel and at right angles to sides of box. Uninsulated conductors shall not extend more than 1/8” from terminal lug.

J. Do not splice conductors in enclosure. Connections shall be made in suitable junction box located exterior of switch

K. Conductors not terminating in switch shall not extend through or enter switch enclosure

3.2 MOUNTING AND SUPPORT

A. Locate switches to provide working clearance and fully accessible as required by the NEC. Do not mount switches directly to or on any mechanical equipment.

B. Enclosure shall be secured to structure by a minimum of four (4) fastening devices. Disconnect switches 600 ampere and larger shall have a minimum of eight (8) fastening devices. A fender washer (minimum 1 1/4" OD) shall be used between head of screw and enclosure.

C. Install equipment with operating handle at 5'-0" AFF, unless otherwise noted.

D. Where enclosure is not indicated on a wall or structure, construct a metal channel (power strut) free standing frame secured to floor, pad, or building structure. In exterior applications, all support structure shall be galvanized.

E. Where disconnect switch is mounted on drywall partitions, provide 3/4" painted plywood backboard exceeding switch size by one (1) foot in each direction, secured to drywall studs and fasten switch to backboard.

F. Provide specified nameplates on feeder switches, fused disconnect switches and non-fused disconnect switches.

END OF SECTION 262816

SECTION 263213 - EMERGENCY POWER SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260000.

B. This section covers the Emergency Power System which shall consist of one engine-driven generator set which contains an engine directly coupled to an electric generator, together with the necessary controls, accessories, critical silencer, skid mounted tank, engine jacket heater, battery charger, remote alarm panel, weatherproof housing, transfer devices, and fuel supply to provide electric power in the event of a failure of the normal power supply

1.2 QUALITY ASSURANCE

A. The following specifications and standards are incorporated into and become a part of this specification by reference. Except where a specific date is given, the issue in effect (including amendments, addenda, revisions, supplements, and errata on the date of invitation for bids, shall apply. In text, such specifications and standards are referenced by basic designation only.

1. National Fire Protection Association (NFPA):
   NFPA-110 - Emergency and Stand-By Power Systems.
2. Electrical Generating Systems Association: (ESGA) Standards:
   EGS A CEP2 - Codes for Emergency Power by States and Major Cities
   EGS A GTD3 - Glossary of Standard Industry Terminology and Definition.
   EGS A ECB1 - Performance Standard for Engine Cranking Batteries
   EGS A TSS1 - Performance Standard for Transfer Switches for use with Engine Generator Sets
   EGS A BCES1 - Performance Standard for Battery Chargers
   EGS A ICAE - Performance Standard for Electric Generator Set Instrument Control and Auxiliary Equipment.
3. Institute of Electrical and Electronics Engineers (IEEE) Standards:
   IEEE 446 - IEEE Recommended practices for Emergency and Standby Power Systems
   IEEE 472 - Voltage Surge Withstand Capabilities
4. National Electric Manufacturers Association (NEMA) Standards:
   MG-1 - Motors and Generators
   ICSI-109 - Test and Test Procedures for Automatic transfer Switches
   ICS2-447 - A.C. Automatic Transfer Switch
5. Underwriters Laboratories Inc. (U.l.) Publications:
   UL 142 – Aboveground Fuel Tanks
   UL 1008 - Automatic Transfer Switches
6. American National Standards Institute (A.N.S.I.):
   C37.90a - Voltage Surge Withstand Capability

1.3 SUBMITTALS

A. Refer to Section 260000 for submittal requirements.

B. Manufacturer's Product Data: Submit material specifications and installation data for products specified under Section 2 - Products to include:

1. Product data for the engine driven generator sets shall contain not less than the information listed as follows:

a. Certification that the engine driven generator set(s) furnished will serve electrical loads indicated including motor starting loads with type (s) of starting indicated.
b. Continuous and stand-by rating of engine driven generator set(s) including voltage and phase.
c. Frequency and voltage regulation with maximum instantaneous voltage dip and time of recovery to stable operation.
d. Output voltage adjustment range in percentage of rated plant voltage.
e. Alternator type and method of connection to prime mover.
f. Components contained in engine instrument panel.
g. Rating of engine at operating speed, engine cycle and number of cylinders.
h. Type of engine lubrication system and verification of components specified.
i. Type of engine governor.
j. Components contained in engine instrument panel.
k. Fuel consumption at rated load.
l. Starting batteries including ampere hour rating.
m. Verification that all accessories specified are to be provided. This includes cold weather starting aid with rating and voltage indicated, exhaust system with muffler type indicated.

2. Product data for the transfer switch shall contain not less than the information listed as follows:

a. List of accessories contained in the control panel.
b. Withstand rating in RMS symmetrical amperes.

C. Shop Drawings: Submit shop drawings to indicate information not fully described by the product data to indicate compliance with the contract drawings. Include layout of all equipment.

D. Submittals shall include the nearest location of permanent parts outlet from which parts may be obtained and written assurance that trained service personnel will be available on 24 hours' notice.

E. Operation and Maintenance Data: Include in each operation and maintenance manual, one set of operating, maintenance, and parts manuals covering all components for the EGS. Provide instructions to the owner in operation and maintenance of his equipment, both in written form and with on-site personnel including a factory technician from the paralleling switchboard manufacturer.

F. Submit shop drawings to Local Authority Having Jurisdiction and/or State Fire Marshal, as required.

G. Where the project includes a fire pump (typically sized by a design/build sub-contractor), the generator submittal shall include a sizing report from the generator manufacturer. This report shall be the output of a computer model that includes the final fire pump size and starting method, coordinated with the equipment to be purchased by the fire protection sub-contractor. Final coordination shall also occur with the elevator manufacturer to verify final motor size.

PART 2 - PRODUCTS

2.1 ENGINE GENERATOR SET

A. General: This system shall include one engine generator set and as represented in the published specifications for that model. Each set shall be rated for KW as indicated on the plans at 0.8 PF, 60 Hz, 3 phase, 4 wire, 208 or 480 volts (as indicated on plans) on a continuous standby basis. Each engine generator set shall be mounted on a heavy duty steel base to maintain proper alignment between components, and each set shall incorporate vibration isolators of the type and quantity as specified by the set manufacturer.

B. Engine: Engine shall be stationary, liquid cooled, spark ignited for diesel operation. Engine shall be capable of driving the generator of this rating on a continuous standby basis for the duration of normal source interruptions per SAE J1349 conditions. The electrical contractor shall be responsible for field coordinating the provision and installation of gas pipe size, length, pressure requirements and point of termination.

C. Engine components shall include the following:

1. A 12 volt DC, solenoid shift, electric starter(s) as required by manufacturer.
2. Positive displacement, mechanical full pressures lubrication oil pump, full flow lubrication oil filter with replaceable element, pressure relief valve, dipstick oil level indicator.
3. Dry element air cleaner with replaceable element.
4. Engine speed isochronous governing system to control generator frequency +/ 0.25% of rated frequency under steady state load conditions, and capable of parallel operation with load sharing controls. Where electronic governing systems are factory installed as standard equipment, and without additional cost, the mechanical governing system shall not be required.
5. Engine mounted thermostatically controlled water jacket heater to aid in quick starting. Heater shall be rated as recommended by engine manufacturer and be disconnected whenever the engine starts. Contractor shall provide proper circuit from normal utility power source.
6. Engine protection devices shall have sensing elements located on the engine to initiate the following alarms and engine shutdowns:

    a. Low lubrication oil pressure shutdown with indicator
    b. High coolant temperature shutdown with indicator
    c. Overspeed shutdown with indicator
    d. Overcrank lockout with indicator

7. Provide low coolant shutdown, which shall activate high engine temperature lamp and shutdown.
8. Engine starter battery charging alternator, with solid state voltage regulator.

D. ENGINE COOLING SYSTEM

1. Engine shall be radiator cooled by engine mounted radiator system including belt driven pusher fan, coolant pump, and thermostat temperature control. Performance of components shall be as required by the manufacturer.
2. The generator equipment supplier shall provide and install 50% ethylene glycol antifreeze solution to fill engine cooling system at start-up.

E. ENGINE EXHAUST SYSTEM

1. Exhaust muffler shall be provided for each engine of size(s) as recommended by manufacturer. Muffler shall be of the critical type, mounted on top of weather protective housing with tail pipe and rain cap.
2. Flexible exhaust connection shall be provided as required for connection between engine exhaust manifold and exhaust line, in compliance with applicable codes and regulations.
3. All exhaust system components shall be properly sized to assure proper operation without excessive back pressure when installed. Make provisions as required for pipe expansion and contraction.

F. GENERATOR

1. Generator shall be single bearing, self aligning, four pole, synchronous type, revolving field, with amortisseur windings, with direct drive centrifugal blower for proper cooling and minimum noise, with temperature compensated solid state voltage regulator, with brushless rotating rectifier exciter system. No brushes will be allowed. Generator shall be directly connected to engine flywheel housing and driven through a flexible coupling to insure permanent alignment. Insulation shall meet NEMA standards for Class F type. The maximum temperature rise shall not exceed 100 degrees C at 40 degree C ambient. Generator design shall prevent potentially damaging shaft currents.
2. The three phase, broad range, re-connectable generator shall have 12 leads brought out to allow connection by user to obtain any of the available voltages for the unit.
3. Voltage regulator shall be solid state design and shall function by controlling the exciter magnetic field between stator and rotor to provide no load to full load regulation of rated voltage within +/- 2% during steady state conditions. The engine generator set and regulator must sustain at least 90% of no load voltage for ten (10) seconds with 250% of rated load at near zero power factor connected to its terminals. A rheostat shall provide a minimum of + 5% voltage adjustment from rated value.
4. The generator, exciter, and voltage regulator shall be designed and manufactured by the engine generator set manufacturer so that the characteristics shall be matched to the torque curve of the prime mover. This design allows the prime mover to use its fullest power producing capacity (without exceeding it or over compensating) at speeds lower than rated, to provide the fastest possible system recovery from transient speed dips.
5. Exciter shall be three phase, full wave, rectified, with heavy duty silicon diodes mounted on the common rotor shaft and sized for maximum motor starting loads.
6. Generator design shall be of the self protecting type, as demonstrated by the prototype short circuit test as described under "Testing" herein. All other generator performance criteria shall be equal to that of the specified equipment.

H. ENGINE-GENERATOR SET CONTROLS

1. Provide a lighted, unit mounted control module that is factory built, wired, tested, and mounted by the generator manufacturer.
2. Engine generator set control shall include the following:

    a. Gauges and meters: oil pressure gauge, coolant temperature gauge, charge rate voltmeter and running time meter.
    b. Manual selector switch: RUN OFF/RESET-AUTO

3. Remote, two wire controls start up terminals.
4. Manual reset safeguard breaker.

5. Automatic engine shut down for the following fault conditions:

    a. Overcrank
    b. Overspeed
    c. Low oil pressure
    d. High engine temperature

6. Indicator lamps shall be provided to signal the following functions:

    a. SYSTEM READY indicates system is in "AUTO" mode
    b. PRE LOW OIL PRESSURE indicates oil pressure is marginally low
    c. PRE HIGH ENGINE TEMPERATURE indicates engine temperature is marginally high
    d. LOW OIL PRESSURE indicates engine has shut down because of critically low oil pressure
    e. HIGH ENGINE TEMPERATURE indicates engine has shut down because of critically high temperature
    f. OVERSPEED indicates engine has shut down because of excessive r/min
    g. OVERCRANK indicates the starter has been locked out because cranking time was excessive
    h. LOW ENGINE TEMPERATURE indicates engine temperature is marginally low for starting
    i. GENERATOR BATTERY FAIL indicates that battery no longer will hold a charge.
    j. LOW FUEL indicates fuel supply is sufficient for only 2.5 hours run time at full load, on secondary tank.
    k. FUEL LEAK indicates that fuel is leaking from the primary tank.
    l. GENERATOR NOT IN AUTO indicates control switch is not in the "AUTOMATIC" position.
    m. GENERATOR BREAKER OPEN indicates that the generator output breaker is in the open position.
    n. Provide two additional fault condition lamps to be designated later.

7. A fault reset switch shall be provided to clear fault indications and allow restarting of the engine after shut down faults. The control design shall be such that the fault indication shall remain until reset. The fault indicator memory shall not be dependent on the presence of either A C or D C voltage and shall retain the fault status memory even through complete removal and replacement of the starting batteries. The fault reset function shall operate only when the RUN STOP REMOTE switch is in the STOP position.
8. A locking screwdriver type potentiometer shall be provided to adjust the voltage + 5% from rated value.
9. Manual reset exciter field circuit breaker.
10. A locking screwdriver type potentiometer (electronic governor) shall be provided to adjust the speed + 2% from rated value.
11. AC voltmeter, 90 degree scale, 2 1/2" (61.25mm) flange, 2% switchboard meter.
12. AC ammeter, 90 degree scale, 2 1/2" (61.25mm) flange, 2% switchboard meter.
13. Frequency meter 45 65 Hz., 90 degree scale, 2 1/2" (61.25mm) flange, +0.6 Hz panel meter.
14. Four position AC meters phase selector switch to read line current and voltage in each phase with off position.
15. The integrity of the generator control wiring shall be continuously monitored as required by NEC 700.10 (D). Loss of integrity of remote start circuit shall annunciate visually and audibly at both the generator and at the remote annunciator panel. This loss of integrity shall also cause the generator to start.

I. AUXILIARY EQUIPMENT

1. Starting Battery: One (1) battery system, consisting of nickel-cadmium batteries, shall be supplied for each engine and shall be mounted in a battery rack within the engine generator set skidbase.
2. Battery Charger: A voltage regulated battery charger shall be provided for each engine generator set. Chargers shall be equipped with float, taper, and equalize charge setting. The charger power shall be supplied from the normal source; contractor shall provide circuits as required.
3. Vibration Isolators: Each engine generator set shall be mounted on vibration isolators either internal or external to the set skid base.
4. A 120 VAC heater with thermostat shall be provided within the engine generator set control panel to eliminate condensation.
5. Remote Alarm Annunciator: Provide remote alarm annunciator for engine generator set with light indicators for all points being monitored at the genset (item H.6 above).
6. Electrical contractor shall provide necessary circuits from normal utility source as required for both the heater and battery charger.
7. A weather protective housing with level 2 sound attenuation and access panels and ventilation openings. Enclosure dimensions to match sub-base fuel tank.
8. Skid mounted, two-hour-rated fuel tank, shall provide 96-hour run-time at 100% full-capacity, shall be 9,300 gallons, with initial fill and re-filled after testing. Provide double-walled tank. If, due to capacity, sub-base tank height causes either the output circuit breaker or the controls to exceed 72” above grade, a custom platform walkway and stairs shall be provided with tank and enclosure around the generator.
9. Provide generator output breaker(s) as shown on the drawings. Provide two-bolt compression-type lugs. Per NEC 700.31, ground fault indication shall be provided.

2.2 AUTOMATIC TRANSFER SWITCHES

A. Furnish and install automatic transfer switches with number of poles, ampere rating, voltage and withstand ratings as shown in plans. This system shall be the product of one manufacturer. The system shall be listed to the latest requirements of Underwriters' Laboratories Standard UL-1008 and rated for Total System Load.

B. Electrical operation shall be accomplished by a momentarily energized single solenoid operating mechanism which receives power from the source to which the load is being transferred. Fuse or thermal protection of the main operator is prohibited. The operating transfer time shall be one-sixth of a second or less. Mechanical locking in each position shall be accomplished without the aid of permanent magnets, latching solenoid, or motor operators.

C. Operation shall be inherently double-throw whereby all contacts move simultaneously and with no programmed delay in a neutral position. Electrical spacings shall be equal to or exceed those listed in table 15.1 of UL-1008. Only those main contact structures specifically manufactured for transfer switch service shall be acceptable. An overload or short circuit shall not cause the switch to go to a neutral position.

D. Inspection of all contacts (movable and stationary) shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The maintenance handle shall permit the operator to stop the contacts at any point throughout the entire travel to properly inspect and service the contacts when required.

E. The transfer switch shall have fully rated neutral transfer contacts which momentarily interconnect the neutrals of the sources and load for 100 milliseconds maximum, during the transfer/ retransfer operation. The neutrals shall remain so interconnected until the line contacts close on the alternate source. Line and neutral contacts shall be driven by a single main operator.

F. Provide two-bolt compression-type lugs for feeder terminations within transfer switch.

G. The automatic transfer switch shall include a separately mounted control panel with adjustable solid state sensing and timing functions. The following operational characteristics shall be provided:

1. Time delay on momentary dips in normal source (0.5-6.0 seconds) factory set at 1.0 second.
2. Time delay on transfer to emergency for controlled loading of generator (0-5 minutes), factory set at 0 minutes or as shown on plans.
3. Time delay on retransfer to normal (0-30 minutes), factory set at 0 minutes.
4. Toggle switch to manually bypass time delay on retransfer.
5. Time delay on engine shutdown after retransfer to normal (0-5 minutes), factory set at 5 minutes.
6. Close differential voltage sensing of all normal source phases (pickup 85-100% of nominal and dropout 75-98%), factory set at 85% dropout and 95% pickup of nominal.
7. Independent single phase voltage (85-100%) and frequency (90-100% pickup) sensing of the emergency source to prevent premature transfer, factory set at 90% voltage and 95% frequency of nominal.
8. Test switch (momentary type). To simulate failure of normal source.
9. Gold plated 10 amp contact which closes to initiate engine starting.
10. Pilot lights to indicate switch positions.
11. Auxiliary contacts (1 closed on "Normal" and 1 closed on "Emergency") rated 10 amps, 480 VAC.
12. An inphase monitor shall be provided. The monitor shall control transfer/retransfer operation between live sources so that closure on the alternate source will occur only when the two sources are approaching synchronism and the two sources are within 15 electrical degrees maximum so that inrush currents do not exceed normal starting currents. The monitor shall function over a frequency difference range of up to +2.0 Hz. with a maximum operating transfer time of one-sixth of a second. If the voltage of the load-carrying source falls below 70%, the inphase function shall be automatically bypassed. The monitor shall not require interwiring with the generator controls, or active control of the governor.
13. All time delay and sensing functions shall be adjustable over the ranges indicated and operated with minimum drift (not to exceed 3%) over -20 degrees C. to +70 degrees C. The control panel shall be provided with a protective cover. The control panel shall not draw more than 15 volt-amperes continuously under normal operating conditions.

H. The switch must comply with UL-1008 and NEMA Std. Pub. ICS2-447. In addition, the switch must meet or exceed the following requirements and if so requested, by verified by certified laboratory test report:

1. Temperature Rise: Measurements shall be made after the overload and the endurance tests.
2. Withstand: UL listed to withstand the magnitude of fault current available at the switch terminals when coordinated with respective protective devices as shown on the plans at an X/R ratio or 6.6 or less. The main contacts of the transfer switch shall not trip open or weld when subjected to fault currents.

3. Dielectric: Test, following the withstand current rating test, at 1960 VAC rms minimum.
4. Transient Withstandability: Control panel voltage surge withstand capability test per IEEE Std. 472-1974 and voltage impulse withstand test per NEMA Std. Pub. ICS-1-109.

2.3 ACCEPTABLE MANUFACTURERS

A. Products of the following manufacturers, which comply with these specifications, are acceptable:

1. Engine driven generator sets: Caterpillar, Cummins, Generac, Detroit Diesel, Kohler.
2. Transfer Switches: ASCO, Russelectric, ABB (GE)

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Installation: Emergency generator and all components shall be installed, including all connections, at locations and as indicated on drawings, and in accordance with approved shop drawings, manufacturer's instructions, and manufacturer's standard specification and dimension sheets.

B. Instruction, Drawings, Parts and Operation Information: Two copies of complete instructions shall be in booklet form and shall consist of operating and maintenance of the equipment and major components supplied.

C. Owner Orientation: A representative of the supplier shall meet with representative of the owner at the time of final acceptance tests, shall review the operation and parts books, correct starting and control methods, and recommend preventive maintenance procedure.

3.2 SPECIAL TESTING

A. The assembled engine-generator set is to be tested at the Engine manufacturer's location to ensure proper operation of the individual components, subassemblies, and the complete assembly. The test shall be run under the same conditions that will exist at the site, i.e. physical constraints such as louvers, grates, environment, etc. All electrical and mechanical defects shall be remedied during testing.

1. The following procedure shall be used:

a. Confirm all variable settings to engine-generator switchgear specifications.
b. Start unit and run at no load for five minutes, making an audible and visual check for abnormal noises, vibration, water and oil leaks.
c. Increase to 50% load for a minimum of thirty minutes. Record test data at end of run, at steady state.
d. Increase to 100% load for a minimum of thirty minutes. Record test data at end of run, at steady state.
e. Drain all water and oil.

f. Apply nucle oil or equivalent preservative to intake manifolds and oil pan sufficient for one year's engine protection.
g. Required test data:

1) Time and reading
2) Ambient air temperature
3) rpm
4) KW
5) AC voltage, phase-to-phase
6) AC amperes
7) Frequency
8) Exciter field voltage
9) Exciter field amperes
10) Jacket water temperature from engine
11) Lubrication oil pressure to engine
12) Lubrication oil temperature from engine
13) Intake manifold pressure/vacuum
14) Crankcase pressure

h. All safety shutdown points shall be set, tested, and recorded. Recorded charts shall be made of voltage and frequency for all load change.

2. Testing

a. An installation check, start-up, and load test shall be performed by the engine manufacturer's local representative at a time agreed upon by site engineer, operators, and maintenance staff. This representative must have received factory training within the previous two years. Resistive load banks shall be provided. Test shall be minimum four hours at full load.
b. The test shall consist of the engine manufacturer's standard procedures. Testing shall meet requirements of NFPA 110-7.13.4.1.4. All associated auxiliary systems shall be tested for proper connections and interaction with the engine-generator set.
c. Four hours of monthly testing is recommended.

3.3 TRAINING

A. The engine manufacturer's representative shall provide on-site training to Owner. Training shall include maintenance, parts ordering, safety, automatic operation, manual operation, engine safeties, protective relaying, complete system operation, troubleshooting, and a complete review of operation and service manuals.

END OF SECTION 263213

SECTION 264113 - LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260000.

B. The work required under this section of the specifications consists of the installation of lightning protection systems. All materials and devices which are an integral part of the lightning protection system shall be provided under this section of the Specifications.

C. Definitions: Terms as defined in UL 96A shall apply in this section.

1.2 QUALITY ASSURANCE

A. The following standards are incorporated into and become a part of this specification by reference.

1. American National Standards Institute:
   C2 National Electrical Safety Code
   C62.1 Surge Arresters for Alternating - Current Power Systems
   C62.2 Guide for Application of Valve Type Surge Arresters for Alternating-Current Systems
   C114.1 (IEEE Std 142); IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems
2. Underwriters Laboratories, Inc.
   UL 96 Lightning Protection Components
   UL 96A Installation Requirements for Lightning Protection Systems
3. Lightning Protection Institute
   LPI-175 Lightning Protection Installation Standard
   LPI-176 Lightning Protection System Material and Components Standard
   LPI-177 Inspection Guide for LPI Certified Systems
4. National Electrical Manufacturers Association
   Std. Pub. No. LA-1 Surge Arresters.
5. Institute of Electrical and Electronics Engineers Std. 142 - IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems
6. NFPA 780

B. Acceptable Manufacturers: Firms listed as a manufacturer of lightning protection system components by Underwriters' Laboratories, and who are members in good standing of Lightning Protection Institute.

C. Coordination

Review shop drawings submitted under this and other sections, as well as other divisions, to ensure coordination between work required among different trades. Coordinate the installation sequence with other Contractors to avoid conflicts and to provide the fastest overall installation schedule. Coordinate installation with architectural and structural features,

equipment installed under other sections of the specifications and electrical equipment to insure access.

1.3 SUBMITTALS

A. Refer to Section 260000 for submittal requirements.

B. Submittals: Submit manufacturer's data on lightning protection systems and associated components.

1. Submit shop drawings to indicate information not fully described by the product data to indicate compliance with the contract drawings. Include layout indicating all system components and interconnection with each component identified for this project. Typical layouts are not acceptable.
2. UL Certification: Provide Owner with UL master label for overall system which is suitable for fastening to building for display purposes. Comply with UL 96A, "Master Labeled Lightning Protection Systems".

C. Manufacturer's Product Data:

Submit material specifications and installation data for products specified under Section PART 2 - PRODUCTS to include:

1. Air Terminals
2. Conductors
3. Bonding Plates
4. Cable Connectors
5. Grounding Plates
6. Lightning (Surge) Arresters
7. Rod Clamps
8. Splicers

PART 2 - PRODUCTS

2.1 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. General: Provide lightning protection system material and components, of types, sizes, ratings, for Class I (buildings under 75’ in height) or Class II service, which comply with manufacturer's standard materials, design, and construction in accordance with published product information, and as required for complete installation. Where type of components or materials are not otherwise indicated, comply with NFPA 780 and LPI standards. Nothing below shall require a Class I building to meet Class II standards.

B. Installation Materials:

1. System components to be made of copper where possible, or aluminum as is compatible with the surface on which they are to be installed.
2. Components:

a. Air Terminals: Solid copper; bright nickel plated; minimum diameter 1/2", minimum length 15 inches.
b. Main Conductors: Rope lay copper cable consisting of 28 strands of 14 gauge copper wire. Minimum weight 380 lbs. per 1,000 ft. Area of conductivity 115,080 cm.
c. Secondary Conductors: Solid soft copper wire. 80 lbs. per 1,000 ft. Area of conductivity 26,240 cm.

C. Ancillary Components:

Connectors: Bronze or stainless steel thru-roof right angle cable connector, 5/8" threaded stem to fit roof thickness.

Connectors: Bronze parallel Bolt Pressure type to connect main conductors.

Splicers: Bronze straight cable splicer. Four hex bolt pressure type for splicing main conductors.

Ground Rod: Solid copper clad 3/4" diameter x 10'.

Ground Rod Clamp: 3-inch direct contact along axis of cable and rod. Two 5/16" hex bolts and nuts.

Ground Plate: Sheet Copper 20 awg thick. 36" wide x 36" long with integral cable connector.

Bonding Plate: Cast bronze flat plate with 8 square inches of bonding surface. Bolt tension cable grip.

Surge Arrestor: Surge Arresters shall be provided in accordance with section 158 Lightning Protection Institute Standard of Practice 175.

PART 3 - EXECUTION

3.1 INSTALLATION OF LIGHTNING PROTECTION SYSTEMS

A. Install lightning protection systems as indicated, in accordance with equipment manufacturer's written instructions, and in compliance with applicable requirements of NEC, NFPA 780, and UL 96A to ensure that lightning protection systems comply with requirements.

B. Coordinate with other work, including electrical wiring and roofing work, as necessary to interface installation of lightning protection system with other work.

C. Install conductors with direct paths from air terminals to ground connections avoiding sharp bends and narrow loops.

D. Install arresters as close as practical to equipment which they are to connect, including telephone service entrance and all radio, TV, satellite lead-ins.

3.2 DOWN CONDUCTORS

A. Down conductors shall be installed in schedule 40 1" PVC conduit. Each perimeter roof cable shall be connected to at least 2 down leads or the down leads may be tied directly to the rebar prior to pouring the columns. The average distance between down leads shall not exceed 100', from upper roof to lower roof, or from roof to ground terminals. Irregularly shaped structures may require extra down conductors to provide a two way path to ground from each air terminal.

3.3 AIR TERMINALS

A. Minimum 10 inches above object.

B. Maximum 20 foot spacing on roof ridges, parapet, etc.

C. Maximum 25 foot spacing with 24 inch long air terminals.

D. Maximum 24 inches from ridge edges or outside corners of building.

E. Midroof areas are to be protected with air terminals of sufficient quantity and height to insure the entire roof is covered by a zone of protection as afforded by a 150-foot radius ball per NFPA 780 and U.L. 96A.

F. All metal pipes shall be bonded to lightning protection system.

3.04 INTERCONNECTION OF METALS

A. All metal bodies within 6' of the conductor shall be bonded to the system with approved fittings and conductor. Connections between dissimilar metals shall be made with approved bimetallic connections.

B. Bonding of all metallic objects and systems at roof levels and elsewhere on the structure shall be complete. Primary bonds for metal bodies of conductance shall be bonded with appropriate fittings and full-size conductor; and shall consist of, but not limited to, the following: Roof exhaust fans, HVAC units with related piping ductwork, exhaust vents and any other roof piping systems, cooling towers, and rail systems, window washing tracks, antenna mast for TV, radio and microwave, flag poles, roof handrails and/or decorative screens, roof ladders, skylights, metal plumbing stacks, etc. Exterior architectural metal fascia and/or curtain walls or mullions, which extend the full height of the structure shall also be bonded, if not inherently bonded through the building frame.

C. Metal bodies of inductance located within six (6) feet of a conductor or object with secondary bonds shall be bonded with secondary cable and fittings. Typical of these are: roof flashings, parapet coping caps, gravel guards, isolated metal building panels or siding, roof drains, down spouts, roof insulation vents and any other sizable miscellaneous metals, etc.

3.5 GROUNDING

A. Grounding terminals shall be located at the base of the structure. Ground connections shall be made around the perimeter of the structure and in no case shall average over 100 ft. apart.

B. Grounding shall be suitable for the soil conditions per NFPA 780. This shall include ground rods only for buildings less than 60 feet high.

C. For buildings over 60 feet in height, a ground loop shall be furnished for full-sized main lightning protection cable. If over 200 feet in height, intermediate level and roof level potential equalization ring will be required (not required for steel frame buildings).

D. Ground connections shall be attached to the steel columns at the lowest available point with bonding plates having a surface area of not less than 8 square inches or shall be cad welded to cleaned areas of the structural columns. Ground terminals shall be 3/4" in diameter and shall be driven to a minimum depth of 10' and more if necessary, to reach permanent moisture. One ground shall have connection to the water system where the water supply enters the building - in addition to artificial ground. In case of rock ledge or other conditions making it impossible to comply with the above, trenching or a copper ground plate will be permitted, providing it will meet the Underwriters Laboratories, Inc. requirements.

E. Provide necessary common grounds between the lightning protection system and the electric and telephone service wires, TV and radio antenna ground.

F. Provide equipment grounding and bonding connections, sufficiently tight to assure permanent and effective grounds and bonds, for lightning protection connection devices as specified.

3.6 FINAL ACCEPTANCE

A. Procurement of U.L. Certification (Master Label or Letter of Findings)

B. Installation of U.L. Master Label plate on building, if applicable.

C. Installation of Manufacturer’s Nameplate on building.

D. Any component or method found not to be in accordance with this specification shall be replaced or repaired without cost to the Owner.

END OF SECTION 264113

SECTION 264313 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260000.

B. This section describes the electrical and mechanical requirements for a modular, high-energy surge protective device (abbreviated as SPD throughout), formerly known as TVSS. The system shall provide protection for sensitive electronic devices against the harmful effects of surges, transients and electrical line noise.

C. Provide SPD unit at each location noted on plans; at minimum, one device at the load side of the service entrance, if not shown.

1.2 STANDARDS

A. The most recent edition of he specified unit shall be designed, manufactured, tested and installed in compliance with the following standards:

1. ANSI/IEEE C62.41.1-2002, C62.41.2-2002 and C62.45-2002
2. Canadian Standards Association (CSA)
3. Federal Information Processing Standards Publication 94 (FIPS PUB 94)
3. National Electrical Manufacturers Association (NEMA) LS-1.
4. National Fire Protection Association (NFPA 20)
5. National Electric Code, Article 285
6. Underwriters Laboratories (UL 1449 and 1283)
7. Institute of Electrical and Electronic Engineers (IEEE)
8. Occupational Safety and Health Act (OSHA)

B. The system shall be UL listed and labeled under UL 1449 (Third Edition) Standard for Transient Voltage Surge Suppression including UL listed short circuit (fault) current rating and the ratings shall be permanently affixed to the SPD. The units shall also be listed and labeled to UL1283 Standard for Electromagnetic Interference Filters.

1.3 QUALITY

A. The system shall meet the following requirements:

1. Protection Modes. In accordance with NEMA Standard LS 1, the unit shall provide protection in all modes. Wye-configured systems shall provide Line-to-Neutral, Line-to-Ground, and Neutral-to-Ground protection. Delta-configured systems shall provide Line-to-Line protection in ungrounded systems and Line-to-Line and Line-to-Ground protection in grounded systems.
2. The manufacturer shall own and operate a surge simulation system which creates an IEEE C62.41.2-2002 Category C3 (20 KV/10 KA) surge event. Testing to be performed to UL 1449 (Third Edition) requirements of a Voltage Protection Rating (VPR) of 6kV/3kA.

3. The SPD system shall meet or exceed the following criteria:

Minimum per mode (L-N, L-G) surge capacity

	High Exposure	Low Exposure
Service Entrance or Transfer Switch	150KA/mode	100KA/mode
Distribution Panels	100KA/mode	80KA/mode
Branch Panels	60KA/mode	50KA/mode

4. The UL 1449 Voltage Protection Rating (VPR) for each mode of protection shall not exceed the following:

System Voltage	VPR			
	L-N	N-G	L-G	L-L
120/208Y	700 volts	700 volts	700 volts	1200 volts
277/480Y	1200 volts	1200 volts	1200 volts	1800 volts

5. The unit shall be UL 1283 listed as an electromagnetic interference filter. The system shall provide a maximum attenuation of 53-dB insertion loss from 100 kHz to 100 MHz when used in a coordinated facility system.
6. The SPD and all components in the suppression path (including all current diversion components) maximum continuous operating voltage (MCOV) shall be 150 volts for 120/208Y systems and 320 volts for 277/480Y systems. The MCOV value shall be a tested value per section 37.7.3 of UL 1449 3rd Edition. MCOV values submitted based solely on the MCOV of the surge components used in the construction of the SPD will not be admitted.
7. The operating frequency range of the system shall be at least 47 - 63 Hz.
8. At service entrance, a UL listed rotary handle disconnect switch shall be provided as a means of disconnect. SPD shall be capable of surviving a single surge at its marketed value with the disconnect installed in the product.
9. The SPD shall be modular in design. Modules shall be fused with a surge rated fuse and incorporate a thermal cutout device.

1.4 SUBMITTALS

A. Equipment Manual. The manufacturer shall furnish with each unit delivered an equipment manual that details the installation, operation and maintenance instructions for the specified unit.

B. Drawings. Electrical and mechanical drawings shall be provided by the manufacturer with the submittal and with each unit delivered that show unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.

C. UL 1449 Listing documentation shall include:

1. Short Circuit Current Rating (SCCR)
2. Voltage Protection Ratings (VPR) for all modes.
3. Maximum Continuous Operating Voltage rating (MCOV).
4. I-nominal rating (I-n).
5. Type 1 Device Listing.

1.5 WARRANTY

A. The manufacturer shall provide a full ten-year parts and labor warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes.

PART 2 - PRODUCT

2.1 ENCLOSURE

A. The SPD enclosure shall be designed for wall mounting and shall be rated NEMA 12. Enclosures that have disconnects shall have type "J" replaceable fuses combined with the disconnect and the system designed so that when the disconnect is in the energized position, the door cannot be opened.

2.2 STANDARD FEATURES

A. The SPD shall include an 8 digit surge event counter with 10 yr. batteries to maintain accurate counts in the event of total loss of power.

B. The SPD must have electrically isolated Form C dry contacts, one normally open and one normally closed to allow connection to the building management system.

2.3 STATUS INDICATION

A. The SPD shall be provided with a monitoring panel complete with mounting bezel and an integral status panel containing externally visible LED status indicators that separately monitor the on-line status of each phase of the unit. An audible alarm (with silence function) shall be provided. Provide diagnostic testing feature.

2.4 INSTALLATION

A. External mounted SPD shall follow manufacturer's recommendation with lead lengths as short (less than 24") and straight as possible and gently twisted together. Re-arrange breaker locations, where required, to minimize lead lengths. Where lead lengths shorter than 5-feet

cannot be obtained, provide low-impedance cable (such as Current Technology HPI system). Indicate separate pricing for low-impedance cable.

B. Units integral to the switchgear shall not be allowed

C. Disconnect switch shall operate such that the protected panel remains energized during service of SPD. No circuit breaker shall be required for this Type 1 device.

D. Before energizing, installer shall verify service and separately derived system neutral-to-ground bonding jumpers per NEC.

2.5 ACCEPTABLE MANUFACTURERS

A. The unit shall be designed and manufactured in the USA by a qualified manufacturer of the suppression filter system equipment. The qualified manufacturer shall have engaged in the commercial design and manufacture of such products for a minimum of five (5) years.

B. Acceptable manufacturers are Current Technology, Liebert, United Power, LEA, or pre-approved equal.

2.6 LABELING

A. SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.

B. SPD shall be UL labeled as Type 1, intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls.

C. SPD shall be UL labeled with 20kA I-nominal (I-n) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagrams. Provide conduit, wiring and similar devices necessary for the complete installation. Wiring shall be of the type recommended by the manufacturer, approved by the local authority having jurisdiction and shall be installed in dedicated conduit throughout.

B. Wiring shall be color coded throughout, to National Electrical Code standards.

C. Field Quality Control: The system shall be installed and fully tested under the supervision of a trained manufacturer's representative. The system shall be demonstrated to perform all the functions as specified.

3.2 TESTS

A. Reports of any field testing during installation shall be forwarded to Project Engineer.

3.3 DOCUMENTATION AND TRAINING

A. As a part of the operation and maintenance manuals, provide data to include operating and maintenance instructions, catalog cuts of all equipment and components, all as-builts wiring diagrams and a manufacturer's suggested spare parts list.

END OF SECTION 264313

SECTION 265100 - LIGHTING

PART 1 -GENERAL

1.1 DESCRIPTION

A. All work in this Section shall comply with the provisions of Section 260000.

B. The equipment and materials specified in this Section shall contain no asbestos or PCB.

C. The work of this Section shall include the careful examination of the Architect/Structural and Mechanical drawings so as to become acquainted with the structural features of the building and the location of pipe and ductwork which would alter the location and spacing of outlets for fixtures. Where conflicts develop, same shall be referred to the A/E for a decision as to the proper location.

1.2 JOB CONDITIONS

A. Verify the compatibility of recessed lighting fixtures with the ceiling in which each fixture is to be located.

1.3 PRODUCT HANDLING

A. Deliver fixtures sufficiently in advance of installation to prevent delay of work.

B. Store all materials in a closed building, in original packaging, and protect from damage and the elements.

1.4 SUBMITTALS

A. Shop Drawings: Show fixture locations and support details. Materials shall not be purchased until approved. Include copy of ballast warranty for each type of ballast required.

B. Product Data:

1. Provide lighting fixture submittals in a single, bound and indexed assembly for all lighting fixtures. Incomplete submittals will be returned without processing. Fixture submittals shall contain manufacturer's name and catalog illustration and number, dimensions and details, ballast and diffuser information, metal gauges, pre-treatment and paint data, UL-ETL approval, and connection details. Provide photometric data for fixture with lamp and ballast specified. Provide information on adjustable fixtures if such type fixture is required. Provide fuse type and size when specified.
3. Provide complete lamp submittals of the exact lamp to be used including color temperature, color rendering index and rated lamp life.

C. Substitutions:

1. All substitution requests must be accompanied by a photometric study for both the proposed substitution and the basis of design fixture(s). Each study shall include a lighting watts per square foot calculation.

PART 2-PRODUCTS

2.1 LIGHTING FIXTURES

A. Fixtures shall bear U.L. and manufacturer's label. Furnish and install lighting fixtures as indicated and specified, complete with lamps, required ballasts and accessories. All fixtures shall be provided with Department of Energy lighting facts label.

B. Each lighting fixture shall have been tested and certified for proper operation by the fixture manufacturer for the type mounting and ceiling on/in which it is installed.

C. Confirm exact locations of all lighting fixtures by coordination with the Architectural Reflected Ceiling Plans and mechanical equipment above or on the ceiling. Confirm all ceiling types before ordering lighting fixtures. Each recessed lighting fixture shall have a trim to match the type of ceiling (plaster, exposed grid, concealed spline, exposed panel, etc.) in which it is being installed, regardless of catalog number given. Each lighting fixture recessed in a plastered ceiling of any type shall have a plaster frame.

D. Most lighting outlets are lettered or groups of outlets are indicated by a letter. The lighting fixtures that are indicated by the letters shall be as indicated on the Lighting Fixture Schedule.

E. Each fixture shall be supplied with the necessary straps, supports, hangers, or other miscellaneous materials and devices to install them in a satisfactory manner and to conform to the Architectural treatment in the areas in which they are to be installed. The Electrical Contractor shall consult all Architectural plans in order that he may familiarize himself with all the necessary details for the various units to be installed throughout the building. Failure to do this will not relieve him of the responsibility of furnishing all necessary materials, to perform the function intended for the lighting system shown on the drawings.

F. Fixtures with highly polished reflective surfaces shall not be handled with bare hands, but with clean, grease-free cotton gloves. Surfaces found with finger prints shall be cleaned or replaced with new fixtures.

G. Fixtures shall be furnished with special anodized finishes and colors as indicated in the Lighting Fixture Schedule. Fixtures with special factory applied baked enamel finish must conform to a color sample supplied by the Architect/Engineer. Full-size finished samples of each fixture with special finish and/or color shall be delivered to the Architect/Engineer for written approval when requested.

H. Prior to the application of any finish, all metal parts of all fixtures shall be protected by a rust-inhibiting process. the rust-inhibiting process shall be chemical. No type of sprayed, painted, or dipped primer may be used as the basic rust inhibitor. Any fixtures and /or parts of any fixtures which shall have begun to show signs of rusting or corroding at the time of completion of the job shall be removed and replaced by properly protected metal parts.

K. Fixtures shall be constructed to provide continuous operation when installed in air plenums, or when surrounded with restrictive enclosures. Where space above ceiling is used as an air

plenum changer for either supply or return air, the fixture shall be factory wired in accordance with Article 300.22 of the NEC

L. LED fixtures shall comply with UL Standard 8750, with IES Standards LM-79 and LM-80, and shall have a parts and labor warranty of 5 years minimum on the fixtures and components.

1. User serviceable LED lamps and drivers shall be replaceable from the room side.
2. Dimmable LED fixtures shall have either a 0-10 volt, 3-wire dimming driver, or a two-step (50%-100%) line voltage, two switch controlled dimming driver.

2.2 LAMPS

A. General:

1. The type lamps shall be as specified for each lighting fixture in the Lighting Fixture Schedule.
2. The lamp catalog number is the catalog number for General Electric and is given as a standard of the quality and performance required. Equal lamps by Sylvania, Philips or Westinghouse will be acceptable. When a lamp manufacturer's name is used along with the catalog number in the Lighting Fixture Schedule, it is considered unequaled by any other lamp and shall not be substituted. The lamp performance with energy conserving ballasts furnished under this Section shall be certified by a nationally recognized independent testing laboratory.
3. Contractor shall replace any lamps damaged during shipping or installation with lamps of like manufacturer to those installed in the fixture. Lamps used during construction shall be replaced with new lamps prior to final inspection.

2.3 LED DRIVERS

A. Provide LED drivers of the proper voltage rating to match the circuit voltage from which the units are supplied. All drivers shall bear the UL label.

B. LED drivers shall be electronic, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, comply with NEMA SSL 1, have a sound rating of “A” and be rated for a THD of less than 20 percent at all input voltages.

C. Dimmable LED drivers shall be capable of dimming without LED strobing or flicker across their full dimming range.

PART 3-EXECUTION

3.1 SUPPORT OF LIGHTING FIXTURES

A. All lighting shall be supported from the building structure. The fixtures shall be supported in a manner that will ensure the fixture's weight being equally distributed from each support and the fixture remaining in a level position.

B. Fixtures installed recessed in a suspended ceiling system shall be supported from the building structure with two (2) 12-gauge wires on diagonal corners of the fixture. In addition, the fixture

shall be clipped to members of the ceiling suspension system by approved support means from 410.36(B) or the manufacturer's listed means of support.

C. Fixtures installed in or on any ceiling other than a suspended ceiling system specifically mentioned above shall be supported with concealed steel rods or jack chain. Rods shall be 1/4" diameter minimum, and shall be located where recommended by the fixture manufacturer. Provide a minimum of two (2) supports for each 4' or 8' fixture chassis. Supports shall be maximum of 48" centers. For incandescent fixtures, steel hanging wire may be used by attaching the wire to the fixture mounting frame.

D. Pendant-mounted fixtures shall be stem supported by a fixture stud mounted in the outlet box. Suspended fixtures shall be supported as detailed on the drawings.

E. No light fixtures shall be supported from ductwork, sprinkler piping, or any other foreign systems.

END OF SECTION 265100

SECTION 268115 – EMERGENCY RESPONDER RADIO ANTENNA/REPEATER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish, install, and test a complete and operating Emergency Responder Radio Antenna/Repeater System. The system will support only the Fire Department radio system and no others. Provisions for supporting other public safety systems (e.g. police); cell phone carriers; the Owners' private security and/or maintenance personnel radio systems, etc. – now or in the future – shall not be included.

B. This Section includes the requirements for an Emergency Responder Radio Antenna/Repeater System for the purposes of amplifying Emergency Responder radio signals to achieve minimum signal strength in 95% of all areas on each floor of the building.

C. Final acceptance and approval is required from the local Fire Department in writing prior to contract closeout.

D. Section Includes

1. Bi-directional amplifiers (BDA's)
2. Distributed Antenna System
3. Coaxial cables
4. Splitters and direction couplers
5. UPS
6. All other equipment and components necessary for a complete and functioning Emergency Responder Radio Antenna/Repeater System.

E. Provide separate line-item pricing for the complete system specified in this section. System must be provided by direction of local Fire Department, should preliminary testing indicate that signal strength does not meet minimum criteria.

1.2 REGULATIONS

A. Codes, regulations and standards referenced in the Section are:

1. NFPA 1 – The National Fire Code (including Annex O from 2009)
2. NFPA 70 – The National Electrical Code
3. NFPA 101, Life Safety Code, the Ohio Basic Building Code, and Local Code and Building Authority requirements.
4. NFPA 72-07 National Fire Alarm Code
5. FCC 47 CFR Private Land Mobile Radio
6. 90.219-2007 Services-Use of Signal Boosters
7. ICC 2012 International Fire Code, Code and Commentary
8. ADA "Americans with Disabilities Act"
9. FCC's OET 65 Standards "Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields".
10. FCC Rules Part 22, Part 90 and Part 101.

1.3 DEFINITIONS

A. Definitions:

1. Bi-Directional Amplifier BDA: Device used to amplify band-selective or multi-band RF signals in the uplink, to the base station for enhanced signals and improved coverage.

2. Emergency Responder Radio Coverage System: A two-way radio communication system installed to assure the effective operation of radio communications systems for fire, emergency medical services or law enforcement agencies within a building or structure. A system used by firefighters, police, and other emergency services personnel.

3. Delivered Audio Quality Definitions (DAQ): This is a universal standard often cited in system designs and specifications.

    a. DAQ 1: Unusable, speech present but unreadable.
    b. DAQ 2: Understandable with considerable effort. Frequent repetition due to noise/distortion.
    c. DAQ 3: Speech understandable with slight effort. Occasional repetition required due to noise/distortion.
    d. DAQ 3.5: Speech understandable with repetition only rarely required. Some noise/distortion
    e. DAQ 4: Speech easily understood. Occasional noise/distortion.
    f. DAQ 4.5: Speech easily understood. Infrequent noise/distortion.
    g. DAQ 5: Speech easily understood. Coupled Bonding Conductor (CBC) – The term "Coupled Bonding Conductor" shall mean a bonding conductor placed, e.g. strapped, on the outside of any technology cable, used to suppress transient noise.

4. FCC: Federal Communications Commission

5. OET 65 Standards: FCC's Bulletin 65 provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

6. Public Safety/First Responder: Public Safety or First Responder agencies which are charged with the responsibility of responding to emergency situations. These include, but are not limited to: law enforcement departments, fire departments, and emergency medical companies.

1.4 SUBMITTALS

A. Submit product data for each type of proposed system component specified, including dimensioned drawings showing minimum clearances and installed features.

B. Layout Drawings

1. Component specification sheets shall be 8.5 inch x 11 inch or greater, scaled or dimensioned, with dimensions or scale clearly noted.

2. Floor plan drawings shall be 24 inch x 36 inch minimum with drawings scaled to legible size.

3. Floor plan drawings may include elevation detail names for each elevation view. Sheet title shall include site name, address, sheet number, floor plan number and north arrow. Include site plan view of the subject buildings and surrounding property to clearly indicate the location and orientation of roof mounted outdoor antennas associated with the proposed system.

4. Include a minimum of (1) building elevation depicting the location of any outdoor antennas associated with the proposed system. Include height of antenna centerline above building, orientation, and location of all external grounding connections.

5. Include a detail plan view of all Telecommunications Spaces housing head-end and/or other consolidated equipment, showing the location of the rack(s) and/or enclosure(s) of the Emergency Responder Radio Antenna/Repeater System equipment.

6. Include a separate plan view of each interior floor where indoor antenna systems are proposed. Include antenna numbers, coaxial cable routes, and the locations of any other system components including splitters, couplers, filters, amplifiers, etc. All components shall be named or labeled for reference in power budget calculations tables. Overlay approximated coverage radii indicating –95 dBm downlink (base to mobile) signal strength around each proposed indoor coverage antenna. Include results of any previous coverage testing per grid, if available.

7. Include a minimum of one (1) detail elevation view(s) of all rack(s) and/or enclosure(s) housing the Emergency Responder Radio Antenna/Repeater System equipment.

   Identify each piece of equipment by brand, model number and equipment type (e.g. Acme BA123 RF amplifier).

8. Specify antenna grounding and surge protection in accordance with NEC Article 810.

9. Specify the backup power source (Life Safety), and include calculations to ensure the backup power requirements as specified in this standard are met.

C. Equipment Specification Sheets

1. Provide copies of manufacturer specification sheets of all system components, including:

   a. Amplifiers
   b. Antennas
   c. Coaxial cable, couplers, splitters, combiners, or other passive components

2. Operation and maintenance data

3. Pass band curves in for the uplink and downlink portions of the NPSPAC band for any amplifiers, if not included in #1. Amplifiers may NOT amplify portions of other licensed services, including Nextel and Specialized Mobile Radio Licensee band, or Cellular A or B bands.

4. Backup battery and charging system.

D. Submit wiring diagrams from manufacturer differentiating clearly between factory and field-installed wiring. Include diagrams for each component of the system with all terminals and interconnections identified. Make all diagrams specific to this Project.

E. Submit product certificates signed by the manufacturer of radio system components certifying that their products comply with specified requirements.

F. Submit agenda for training class and copies of all handouts for the class.

G. Maintenance data for radio system shall be included in the operation and maintenance manual. Include data for each type of product, including all features and operating

sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations that carry stock of repair parts for the system to be furnished.

H. Record of field tests of the radio system shall be included in the operation and maintenance manuals.

I. Design Approval: Plans shall be submitted and approved prior to installation. The following information shall be provided to the local Fire Department unit representative by the system designer/Contractor:

1. A minimum of three (3) copies of detailed drawings showing the location of the amplification equipment and associated antenna systems which includes a view showing building access to the equipment; and

2. A minimum of three (3) copies of schematic drawings of the electrical system, backup power, antenna system and any other associated equipment relative to the amplification equipment including panel locations and labeling.

3. A minimum of one (1) copy of the Manufacturer's data sheets on all equipment to be installed.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced factory-authorized installer to perform work of this Section.

B. Single-Source Responsibility: Obtain radio system components from a single source who assumes responsibility for compatibility of system components.

C. All equipment shall be UL listed and labeled, and in accordance with applicable NEMA and ANSI Standards. Where copper cabling is routed to an area, either in another building, or with a separate electrical service, the Technology Contractor shall provide primary protective equipment.

D. All racks and enclosures shall be either welded or assembled with paint piercing ground washers, grounding strip and bonding jumper as indicated on the Drawings.

1.6 MANUFACTURERS

A. Subject to compliance with requirements, available Integrators offering products that may be incorporated into the Work include, but are not limited to, the following:

1. CommScope/Andrew
2. Corning
3. Times Microwave
4. Tessco
5. CCI (Communication Components Inc.)
6. Solid Technologies

PART 2 - PRODUCTS

2.1 GENERAL PERFORMANCE REQUIREMENTS

A. Compatibility: The equipment, including but not limited to repeaters, transmitters, receivers, signal boosters, cabling, fiber distributed antenna system, etc., shall not interfere with the existing communication systems utilized by the Public Safety and First Responder agencies.

B. Power Supplies: At least two (2) independent and reliable power supplies shall be provided, one primary and one secondary. The primary power source shall be supplied from a dedicated 20 ampere branch circuit and comply with 4.4.1.4 of NFPA 72. The secondary power source shall be a dedicated battery, capable of operating the in-building radio system for at least 12 hours of 100% system operation. The battery system shall automatically charge in the presence of external power input. The battery system shall be contained in one NEMA 4 or 4X type enclosures. Monitoring the integrity of power supplies shall be in accordance with 4.4.7.3 of NFPA 72.

C. Survivability

1. Physical Protection: All wiring and fiber optics shall be installed in conduit. Refer to Section 26 05 33, "Raceway Systems" for type, sizing and installation standards.

2. Fire Performance: All main risers or trunks of the antenna system shall be installed with resistance to attack from a fire using one of the following methods:

   a. A 2-hour fire rated cable or cable system
   b. Routing the cable through a 2-hour fire rated enclosure(s) or shaft(s).
   c. A system configured in a looped design, routed through 1-hour fire rated enclosure(s) or shaft(s). The circuit shall be capable of transmitting and receiving a signal during a single open or non-simultaneous single ground fault on a circuit conductor.
   d. Performance alternative approved by the authority having jurisdiction.

3. Cabinet: The signal booster and all associated RF filters shall be housed in a single, NEMA 4 certified, painted steel weather tight box. The cabinet shall be large enough to dissipate internal heat without venting the inside of the cabinet to the outside atmosphere. Operating temperatures: –22 degrees F to +120 degrees F (–30 degrees C to +50 degrees C) minimum temperature range, including microprocessors. Equipment installed on the roof of structures shall be rated for the expected extreme temperatures associated with rooftop installations.

4. Passive Equipment: Passband shall be 700-900 MHz, IP rating of 2 GHz.

5. Cable: Passband shall be 700-900 MHz. Cable shall be rated for fire plenum and riser rating.

2.2 SYSTEM COMPONENTS

A. Signal Strength

1. Downlink: A minimum signal strength of -95 dBm shall be provided throughout the coverage area.
2. Uplink: Minimum signal strength of -95 dBm received at the local Fire Department Radio System from the coverage area.
3. A donor antenna must maintain isolation from the distributed antenna system. The donor antenna signal level shall be a minimum of 15 dB above the distributed antenna system under all operating conditions.

B. Permissible Systems

1. Buildings and structures shall be equipped with an FCC Certificated Class B Bi-Directional UHF Amplifier(s) as needed.
2. The distributed antenna system may utilize a radiating cable, fixed antennas or a combination of both.

C. Supported Frequencies: The radio system shall support frequencies in the 700 and 800 MHz public safety bands as utilized by the local Fire Department.

D. Reject Filters: Notch filter sections shall be incorporated to minimize adjacent channel cellular and SMR (Nextel) degradation of the signal booster performance. The minimum downlink band adjacent band rejection shall be 35 dB or greater at 865 MHz and 870 MHz.

E. Band Migration Capability: The signal booster shall include re-tunable or replaceable filters to accommodate rapid and economic passband changes in the event of mandatory FCC changes within the NPSPAC band. The use of non-adjustable and non-replaceable RF input and output filters is prohibited.

F. Output Level Control: An automatic output leveling circuit shall be included for both passbands with a minimum dynamic range of 60 dB, less any gain reduction setting, to maintain FCC out of band and spurious emission compliance.

G. Degraded Performance in Emergencies: The system shall be designed to allow degraded performance in adverse conditions, such as abnormally high temperatures resulting from nearby fires, extreme voltage fluctuations or other abnormal conditions that may occur during an emergency. Circuits that intentionally disable the signal booster in such situations (i.e. under/over voltage, over/under current, over/under temperature, etc.) will not be implemented as the standard mode for public safety applications.

H. Mode of Operation: The system shall be normally powered on and shall continuously provide passing of frequencies within the Public Safety and First Responder bands.

I. All in-building radio systems shall be compatible with both analog and digital communications simultaneously at the time of installation.

2.3 SYSTEM MONITORING

A. The distributed antenna system shall include a connection to the fire alarm system to monitor the integrity of the circuit of the signal booster(s) and power supplies and annunciate this malfunction on the fire alarm system. The system shall comply with 4.4.7.1 of NFPA 72.

B. A sign shall be located at the fire alarm panel with the name and telephone number of the local Fire Department indicating that they shall be notified of any failures that extend past the 2-hour time limit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Distribution System Signal Wires and Cables

1. Wires and cables shall enter each equipment enclosure, console, cabinet or rack in such a manner that all doors or access panels can be opened and closed without removal or disruption of the cables.
2. Routing and Interconnection

a. Wires or cables routed between consoles, cabinets, racks, and other equipment shall be installed in an approved conduit or cable tray that is secured to building structure.
b. Completely test all cables after installation and replace any that are found to be defective.

3. Install cables without damaging conductors, shield, or jacket.
4. Do not bend cables, while handling or installing, to radii smaller than as recommended by manufacturer.
5. Pull cables without exceeding cable manufacturer's recommended pulling tensions.

B. Product Delivery, Storage, and Handling

1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment model and serial identification numbers.
2. Store and protect equipment in a conditioned space until installation.

C. System Installation

1. Coaxial antenna cabling shall not be installed in the same conduit, raceway, or cable trays used for other systems.
2. All equipment shall be connected according to the OEM's specifications to insure correct installation and system performance.
3. Coordinate all roof penetrations with Owner and/or roofing contractor.

3.2 LICENSING

A. All fees associated with the licensing shall be paid by the Owner.

B. All testing must be done on frequencies authorized by the FCC.

3.3 GROUNDING

A. Ground cable shields and equipment per Manufacturer's requirements.

B. Antenna mast shall be grounded per NFPA 70 NEC requirements, Section 27 05 26, "Grounding" and antenna manufacturer's requirements. Provide grounding blocks and surge protection for outside coaxial cabling. Bond the antenna mast to the existing lightning protection system.

3.4 APPROVAL TESTING

A. The local Fire Department will review plans and specifications. Upon acceptance, plans will be stamped to indicate approval. Stamped plans are required to be present at the acceptance test. Any field changes that occur during construction shall be incorporated into new As-Built plans, including any manufacturer's data sheets for any equipment changes not submitted in the original submittal. As-Built plans, if required due to system changes, shall be submitted to the local Fire Department for approval.

B. Tests shall be made using frequencies close to the frequencies used by the Fire Department and appropriate emergency services. If testing is done on the actual frequencies, then this testing must be coordinated with the local Fire Department unit. All testing must be done on frequencies authorized by the FCC. A valid FCC license will be required if testing is done on frequencies different from the police, fire or emergency medical frequencies.

C. Testing Procedures

1. Minimum Signal Strength: For testing system signal strength and quality, the testing shall be based on the delivered audio quality (DAQ) system. A DAQ level below 3.0 shall be considered a failed test for a given grid cell.

2. Measurements shall be made with the antenna held in a vertical position at 3 to 4 feet above the floor to simulate a typical portable radio worn on the belt or turnout coat pocket.

D. Final Acceptance Testing

1. All acceptance testing shall be done in the presence of a local Fire Department representative or by the local Fire Department unit at no expense to the City.

2. Small scale drawings (11 inch x 17 inch maximum) of the structure shall be provided by the Contractor to the Owner. The plans shall show each floor divided into the grids as described above, and the results of the pre-testing. Each grid shall be labeled to indicate the DAQ result from the final acceptance testing.

3. The Contractor shall provide the latest approved plans for the system, including any manufacture's data sheets for any equipment changes not submitted in the original submittal to the Owner.

4. Include testing results of the repeater (output wattage, gain level, etc) and connection to the fire alarm.

3.5 MAINTENANCE AND ANNUAL TESTING

A. Annual tests will be conducted by the local Fire Department unit or authorized company.

1. The re-testing will be done at no expense to the City or the appropriate emergency services departments as required in the original testing procedures.

B. Maintenance Contract

1. Maintenance contract with a Radio Service Provider in place with name of authorized company, who will provide a 24 hour by 7 day emergency response within two (2) hours after notification. The system shall be maintained in accordance with FCC requirements. The contract shall be for 5 years.

2. All tests shall be conducted, documented, and signed by a person in possession of a current FCC General Radio telephone Operator License, or a technician certification issued by the Association of Public-Safety Communications Officials International (APCO) or equivalent as determined by the local Fire Department.

3. Maintain a list of contact personnel with phone numbers at the radio repeater system cabinet. The contact personnel shall have knowledge of the building and the repeater system and be available to respond to the building in the case of an emergency.

4. Radio Service Provider maintenance contract shall include but not limited to:

a. Annual Test

1) All active components of the distributed antenna system, including but not limited to amplifier, power supplies, and back-up batteries, shall be tested a minimum of once every 12 months.

2) Amplifiers shall be tested to insure that the gain is the same as it was upon initial installation and acceptance. The original gain shall be noted and any change in gain shall be documented.

3) Back-up batteries and power supplies shall be tested under load for a period of 1 hour to verify that they will operate during an actual power outage.

4) Active components shall be checked to determine that they are operating within the manufacturer's specifications for their intended purpose.

5) Documentation of the test shall be maintained on site and a copy forwarded to the local Fire Department Radio Supervisor upon completion of the test.

5. Fire Department Radio personnel, after providing reasonable notice to the Owner or their representative, shall have the right to enter onto the property to conduct field testing to be certain that the required level of radio coverage is present

END OF SECTION 268115

SECTION 27 05 00 - COMMUNICATIONS GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 27 Communications.

B. Applicable provisions of this section apply to all sections of Division 27, Communications.

C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See Division 26 for related general and specific requirements.

1.2 CODES AND STANDARDS

A. All equipment and work performed shall comply with all of the current and applicable Codes, Rules, Ordinances, Regulations and Standards (including those not specifically listed in this Specification) as interpreted and enforced by the authorities having jurisdiction including:
1. Americans with Disabilities Act (ADA)
2. Authorities Having Jurisdiction (AHJ) - Local
3. American National Standards Institute (ANSI)
4. American Society of Testing and Materials (ASTM) Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732
5. Building Industry Consulting Services International (BICSI)
6. Code of Federal Regulations - Title 47
7. Electronics Industries Association (EIA) Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series
8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
9. Federal Information Processing Standards (FIPS) Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176
10. The Insulated Cable Engineers Association (ICEA) Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685
11. International Electro-technical Commission (IEC)
12. Institute of Electrical and Electronic Engineers (IEEE) Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series
13. International Organization for Standardization (ISO) (ISO/IEC) Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1
14. International Telecommunication Union (ITU-T) Telecommunications Standardization
15. National Electrical Code (NEC) National Electrical Code - NFPA 70
16. National Electrical Contractor's Association (NECA) Standards of Installation
17. National Electrical Manufacturers Association (NEMA) Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66
18. National Electrical Safety Code (NESC)
19. National Fire Protection Association (NFPA) - National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101
20. Society of Cable Telecommunications Engineers (SCTE)
21. Local Accessibility Standards
22. Telecommunications Industries Association (TIA) (ANSI/TIA/EIA) Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95

23. Uniform Building Code (UBC)
24. Underwriters Laboratories, Inc. (U.L.) - 497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977

B. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

C. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws, and regulations.

D. Obtain all permits required.

1.03 SUMMARY

A. Provide complete and working Communications Systems including equipment, conduit, wiring, material, labor, and training as described in this Specification and the Drawings. The Communications Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All Communications Systems plans and specifications are to be returned to the Architect following completion of bid.

1.04 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.05 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
    01. Make final connections to all communications equipment indicated on the drawings, except as noted.

F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.

G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.06 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.07 GUARANTEE

A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.08 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.09 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.10 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 27 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit complete design and performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

1.11 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work:
   1. Obtained from utility maps and other substantially reliable sources.
   2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.

B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.12 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

1.13 ABBREVIATIONS AND DEFINITIONS

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CATV	Cable Antenna Television
CCTV	Closed Circuit Television
CMP	Communications Media Plenum
CMR	Communications Media Riser
dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Gbps	Giga Bits Per Second
Hz	Hertz
IC	Intermediate Cross-connect
IDF	Intermediate Distribution Frame
IM	Information Management
IS	Information Systems or Information Services (also see MIS)
IT	Information Technology
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MATV	Master Antenna Television *(A.K.A. Main Antenna Television)*
Mbps	Mega Bits Per Second
MC	Main Cross-connect
MDF	Main Distribution Frame
MHz	Megahertz
MIS	Management Information Systems or Services
NEXT	Near-End Cross Talk
nm	Nano-meter
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
PBX	Private Branch Exchange
POS	Point of Sale
PSELFEXT	Power Sum Equal Level Far-End Cross Talk
PSNEXT	Power Sum Near-End Cross Talk
SMATV	Satellite Main Antenna Television
TC	Telecommunications Closet *(Now referred to as TR)*
T.O.	Telecommunications Outlet
TR	Telecommunications Room *(A.K.A. TC - Telecommunication Closet)*
UTP	Unshielded Twisted Pair Wire

Definitions:

Administration Subsystem - Cable, connectors, cross-connect and inter-connect hardware, patch cords, and other equipment that allows easy reconfiguration of the telecommunications system to accommodate personnel and floor plans changes.

Campus Backbone Subsystem - Connects telecommunications processing equipment in different buildings on the same campus.

Communications Cabling - Any fiber optic, copper, coaxial or other transmission media used for transmitting or receiving communications systems data.

Communications System - Communications Systems and associated wired or wireless interconnection.

Communications Drawings - All floor plans, elevations, details, schematics, block diagrams, legends, tables, notes, or attachments associated with any or all of the Communications Systems.

Distribution Cable - The telecommunications UTP wiring between the telecommunications room and the outlet connectors.

Equipment Subsystem - Telecommunications cable, connectors, support hardware, blocks, and protective devices that serve to connect the network interface and the backbone subsystem through the administrative subsystem.

Horizontal Subsystem - Telecommunications cable, outlets and distribution cords that extend the riser backbone from the administrative points in the TRs to work stations.

Information Systems - Software systems including operating systems, programs, data manipulation and management systems, control software and various forms of proprietary and off-the-shelf software.

Information Technology - The practical application of knowledge associated with designing, installing, and maintaining the equipment, hardware and infrastructure utilized for control, distribution, or display of telecommunications, audio, video and data signals. Because computers are central to information management, computer departments within companies and universities are often called (IT Departments) and are responsible for MIS or IS personnel and services.

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the Communications Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the Communications Systems operational or for system communications.

Management Information Systems - A class of software that provides managers with tools for organizing and evaluating their department. Typically, MIS systems are written in COBOL and run on mainframes or minicomputers. Within companies and large organizations, the department responsible for computer systems is sometime called the MIS department. Another name for MIS is Information Services (IS).

Multiplexer - A communications device that multiplexes (combines) several signals for transmission over a single medium. A multiplexer is sometimes called a "mux". A demultiplexer is required to complete the process by separating multiplexed signals from a transmission line. Frequently a multiplexer and demultiplexer are combined into a single device capable of processing both outgoing and incoming signals.

Riser Backbone Subsystem - Telecommunications cable, splice enclosures, and associated hardware that provide the main cable routes in a building. It interconnects building floors and larger areas of a single floor. It also interconnects administrative points in satellite TRs to the administrative points in the building main equipment room.

Station Cable - The wiring between the outlet connections and the work area equipment.

Communications Systems - One or more of the following and associated equipment: Data/Networking Systems, Telecommunications Systems, Paging / Intercom Systems, Clock/Control Systems, Master Antenna Television Systems, Cable Antenna Television Systems, Broadcast Video Systems, Audio/Visual Presentations Systems, Microwave/Wireless Systems.

Telecommunications - The transmission, emission or reception of signs, signals, images, sound, or intelligence of any nature by wire, radio, optical or other technical transmission system.

Work Area - Location of an employee or student and their data/telecommunications equipment or devices.

Work Area Subsystem - Station mounting cords, extension cords, connectors, adapters, and interface units that provide physical and electrical connectivity between workstation equipment and the horizontal subsystem.

1.14 QUALITY ASSURANCE:

A. Equipment Standards:
1. System and all components shall be brand new stock from manufacturer.
2. All electronics shall be 100% solid state.
3. System and all components shall bear a UL Label.

B. Contractor Qualifications:
At the time of Proposal, the Contractor shall:
1. Have manufactured, supplied, or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
2. Hold all legally required State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
3. Hold all legally required state registrations to meet local requirements for submittal drawings.
4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.15 SUBMITTALS

A. Provide SUBMITTALS according to Division 01 and the following.

B. Requirements:
   1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
   2. Submit proof that all system components and cables are U.L. Listed.
   3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
   4. Product technical information sheets for each principal component in the proposed system, including cable, wire, terminal marking, and wire marking material.
   5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
   6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.16 EXAMINATION OF SITE

A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities do not entitle him to additional compensation for work overlooked and not included in his proposal.

B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.17 DATA ACCURACY

A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.18 SECURITY

A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.

B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.19 UTILITIES

A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.20 PERMITS

A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.21 NOTIFICATION

A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar day's notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

1.22 INTERFERENCES WITH THE OWNER

A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

1.23 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and underslab cables installed, dimensioning exact location and elevation of such installations.

B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2014 / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
   1. 3 sets of electronic AutoCAD (2014 dwg) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
   2. One reproducible Dayrex mylar film positive of each contract as-built drawing.
   3. Three sets of blue or black-line prints of each contract as-built drawing.

C. As-Built Drawings should indicate the following information as a minimum:
   1. Indicate all addendum changes to documents.
   2. Remove Engineer's Seal, name, address, and logo from drawings.
   3. Mark documents AS-BUILT DRAWINGS.
   4. Clearly indicate: DOCUMENT PRODUCED BY:
   5. Indicate all changes to construction during construction. Indicate actual routing of all conduit and cables, etc that were deviated from construction drawings.
   6. Indicate exact location of all underground communications raceways, and elevations.
   7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
   8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.

9. Exact location of all communications equipment in building. Label panel schedules to indicate actual location.
10. Exact location of all communications equipment in and outside of the building.
11. Location, size and routing of all communications cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
13. Cloud all changes.

1.24 OPERATING TESTS

A. After all communications systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.25 WARRANTY

A. All equipment shall be covered for the full manufacturer’s warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.

B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.26 BUILDING CONSTRUCTION

A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.27 TEMPORARY FACILITIES

A. General: Refer to Division 01 for general requirements on temporary facilities.

B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.

C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.28 EXTRA MATERIALS

A. Keys: Provide three (3) sets of all keys for system cabinets.

PART 2 - PRODUCTS

2.01 WORK INCLUDED

A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

PART 3 - EXECUTION

3.01 INSTALLATION

A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.

B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.

C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be assumed to ensure a complete, functional system.

D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals and As-Built drawings.

E. If appropriate, interfaces with the Owner's Data Network, Telecommunications and Communications System shall be coordinated with the Owner and Architect.

F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.

G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a junction box, to the system devices. Provide as required and as specified in Division 26.

H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.

I. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.

J. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.

K. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation if applicable, the more stringent shall apply.

L. Where new equipment is replacing old equipment, the Contractor is responsible for removing and disposing of the old equipment and doing whatever repair work is necessary as specified by the Owner / Architect.

M. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.

N. The installation shall be performed in a professional manner.

O. On a daily basis, clean up and deposit in appropriate containers all debris from work performed under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.

P. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.

Q. All work shall conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.

R. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

3.02 COORDINATION WITH OWNER / ARCHITECT

A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of job progress.

3.03 CUTTING, PAINTING, AND PATCHING

A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.

B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

3.04 WIRE AND CABLE

A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.

B. All wires in exposed areas shall run through conduit as specified in Division 26.

C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.

D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.

E. Run wires continuously from termination to termination without splices.

F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at not rime shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.

G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2” or larger sized conduits.

H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.

I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). Communications cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.

J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

3.05 IDENTIFICATION AND TAGGING

A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 *or equal*). Hand written tags are not acceptable.

B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all Communications Systems wiring.

C. All panels shall be provided with permanently attached engraved lamacoid labels with identifying names and functions. All terminal points shall be appropriately labeled. Labels shall be consistent in form, color, and typeface throughout the system and all must contain the name of the system or subsystem as part of the label textual information. Design, color, font and layout shall be coordinated with, and approved by, the Owner.

D. Identification of Equipment:
   1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions.
   2. A black-white-black 3 layer laminated plastic engraved identifying nameplate shall be permanently secured to each wireway, terminal cabinet, and communications (voice, data, video) cabinet or rack.
      a. Identifying nameplates shall have 1/2-inch high, engraved letters. For equipment designation and ¼-inch letters indicating source circuit designation, (ie: “IDF(FCR) XXYY –served from MDF (BCR) XXGG).
   3. Permanent, waterproof, black markers shall be used to identify each communications grid junction box, clearly indicating the type of system available at that junction box.

4. Pull Boxes: Field work each with a nameplate showing identity, and identifying equipment connected to it. Nameplates shall also indicate where pull box is fed from.
5. Communication hardware located above accessible ceilings: Provide ½-inch high black name plate with white 1/4-inch letters glued to bottom of t-grid ceiling below hardware located above ceiling. Identification shall be as short as possible yet identifying device above ceiling, i.e. “A/V-EQ”.

E. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.

F. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of communications facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.

G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways. Identify with drop/circuit number.

H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red or orange with suitable warning legend describing buried communications lines. All underground conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or duct banks. Provide magnetic marking tape below all underground conduits.

3.06 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 01 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.07 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the communications systems.
1. Provide the training during regular working day.
2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.

B. Time to be allocated for instructions.
1. Minimum of 20 hours dedicated instructor time
2. 4 hours on each of 5 days
3. Additional instruction time for specific systems as specified in other Sections.

C. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
1. One copy to the Owner
2. One copy to the Architect / Engineer

D. The Owner shall provide a list of personnel to receive instructions, and shall coordinate their attendance at the agreed upon times.

E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.08 OPENINGS

A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.09 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
   1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
   2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.10 VANDAL RESISTANT DEVICES

A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.

B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.11 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.12 SITE MANAGEMENT RESPONSIBILITY

A. The Contractor shall provide an on-site Project Manager as defined in SUPERVISION OF WORK portion of this Section.

3.13 START-UP RESPONSIBILITY

A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all Communications Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect’s judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer’s factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.

B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.

C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should include:
   1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
   2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and operational.

3.14 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.

B. All materials shall be neat, clean and unmarred, and parts securely attached.

C. All extra material as specified shall be delivered and stored at the premises as directed.

D. Test reports of each system and each system’s components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

3.15 SYSTEM ACCEPTANCE REQUIREMENTS

A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.

B. The Contractor shall deliver three (3) composite “System Operations and Maintenance” manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:
   1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
   2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
   3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that cam in the original shipping container for that piece of equipment. Include all warranty cards.

C. Testing:
   1. The Contractor shall perform all tests required by Division 26 and those submitted as part of this Section.
   2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
   3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.

D. As-Built Drawings:
   1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
   2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.

E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System’s performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
   1. System Operations and Maintenance Manuals
   2. System Test Reports
   3. As-Built Drawings

3.17 NOTICE OF COMPLETION

A. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION 270500

SECTION 27 05 07 - COMMUNICATIONS SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 01 and as outlined below.

B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.

C. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

D. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relation to adjacent or critical features or work or products.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each room containing technology equipment and each rack with technology equipment, submit plan and elevation drawings. Show:
1. Actual technology equipment and components to be furnished.
2. NEC working space and NEC access to NEC working space.
3. Relationship to other equipment and components and openings, doors and obstructions
4. Rack location and dimensions

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Verify location of communications station devices, telephone outlets and other work specified in this Division.
   1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
   2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.

F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.

1.04 PRODUCT DATA

A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:)

1.05 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

1.06 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Manufacturer's catalog numbers
   4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals

from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
1. Proper sizes and capacities
2. That the item will fit in the available space in a manner that will allow proper service
3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.07 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
1. Shop Drawings and Coordination Drawings: Submit four opaque reproductions.
2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
1. Date
2. Project title and number
3. Contractor's name, address and telephone number
4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
    a. Contractor
    b. Subcontractor
    c. Supplier
    d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or federal specifications numbers
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect / Engineer stamps

11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
2. Associated items requiring correlation for efficient function or for installation

1.08 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
1. The related specification section number
2. The exact specification section title

B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.09 RESUBMISSION REQUIREMENTS

A. Make resubmittals under procedures specified for initial submittals.
1. Indicate that the document or sample is a resubmittal
2. Identify changes made since previous submittals

B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:

1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
3. Return submittals to Contractor for distribution or for resubmission

B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Division 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 SHOP DRAWINGS AND PRODUCT DATA

A. Submittals shall not be combined or bound together with any other material submittal.

B. Submit individually bound shop drawings and product data for the following when specified or provided:
1. Structural Cabling
2. Communications System
3. Sound Reinforcement System

3.02 COORDINATION DRAWINGS

A. Submit coordination drawings as specified.

END OF SECTION 270507

SECTION 27 05 09 - CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.02 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.03 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.04 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.05 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.06 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide a manufacturer’s qualified personnel to observe:
   1. Field conditions.

2. Condition of installation.
3. Quality of workmanship.
4. Start-up of equipment.
5. Testing and adjusting of equipment.

B. Manufacturer's qualified personnel shall make written report of observations and recommendations to Architect/Engineer.

1.07 MOCK UPS

A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.

B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.

C. Acceptable mock-ups in place shall be retained in the completed work where possible.

D. Perform tests and submit results as specified.

1.08 SCHEDULING OF MOCK-UPS

A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
1. Rough-in
2. Finish with all appurtenances in place
3. Demonstrations

PART 2 – PRODUCTS – NOT USED.

PART 3 - EXECUTION

3.01 ADJUSTMENTS AND MODIFICATIONS

A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's qualified personnel at no additional cost to Owner.

3.02 MOCK-UPS

A. Mock-up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. Provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION 270509

SECTION 27 05 10 - FIRESTOPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

B. Types: Firestop required for the project includes smoke stop.

1.2 QUALITY ASSURANCE

A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Nelson.

B. 3M (Minnesota Mining Manufacturing).

C. Hilti

D. Specified Technologies, Inc.

2.2 MATERIAL AND COMPONENTS

A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).

B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and

NFPA standards for the installation of firestops.

END OF SECTION 270510

SECTION 27 10 00 - DATA COMMUNICATIONS STRUCTURED CABLING

PART 1 - GENERAL

1.1 SUMMARY OF WORK

A. Furnish and install horizontal cabling inclusive of Category 6 cabling, jacks, faceplates, patch cords, above-ceiling supports, labels, testing and all supporting equipment to provide a complete and fully functional solution as described in this specification.

B. Furnish and install backbone cabling inclusive of fiber, multi-pair copper, connectors, bulkheads, patch cords, above-ceiling supports, testing, and all supporting equipment to provide a complete and fully functional solution as described in this specification.

C. Furnish and install head-end equipment inclusive of 2-post racks, patch panels, fiber termination boxes, wire managers, ladder rack, fire-rated plywood, power-strips, grounding, and all supporting equipment to provide a complete and fully functional solution as described in this specification.

1.2 QUALITY ASSURANCE – STRUCTURED CABLING

A. Installer Qualifications:
   1. The structured cabling contractor shall be licensed and shall meet all applicable regulations.
   2. The contractor shall be certified by the manufacturing company in all aspects of design, installation, and testing of the products described herein.
   3. The manufacturer shall have, at the district's disposal, a certified employee or support phone number that can be reached during normal operating hours for product support and service.
   4. 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 and metallic premise distribution systems and shall have personnel who are adequately trained in the use of such tools and equipment. Contractor shall provide evidence of minimum five (5) years' experience on similar structured cabling systems.
   5. A resume of qualifications shall be submitted with the contractor's proposal indicating the following:
      a. A list of five (5) recently completed projects of similar type and size with contact names, telephone numbers, and e-mail addresses for each.
      b. A list of procedures, inclusive of testing equipment and best practices, for testing the integrity of the cabling systems on this project.
      c. A technical resume of experience for the contractor's project manager and on-site installation supervisor who shall be assigned to this project.
      d. A list of technical product training attended by the contractor's personnel that shall install the structured cabling systems shall be submitted.
      e. Any subcontractor who shall assist the contractor in performance of this work shall have the same training and certification as the contractor.
   6. The contractor shall employ full time local technicians and installers.

B. The Contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by the Owner's representative prior to the start of the work.
   1. Items requested by the Owner/Engineer to finalize rack equipment configuration, rack cable management, rack cable terminations and other miscellaneous minor changes shall become part of the Contract Documents as supplementary information.

C. The products specified in Part 2 of this Specification shall be supplied by a single manufacturer, within the acceptable manufacturer groups, with the exception of data racks and other hardware that is not defined as part of the channel test configuration by TIA/EIA TSB67, Transmission Performance Specifications for Field Testing of unshielded Twisted-Pair Cabling Systems outside plant (OSP) copper cable. Manufacturer shall have a minimum of seven (7) years' experience and shall be ISO 9001 Certified.

D. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

1.3 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
   1. Local Building Code
   2. Local Electrical Code
   3. NEC National Electrical Code

B. Other references:
   1. ANSI/TIA-568-C.0 – Generic Communications Cabling for Customer Premises...
   2. ANSI/TIA-568-C.1 – Commercial Building Communications Cabling Standard Part 1: General Requirements.
   3. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
   4. ANSI/TIA 568-C.3 – Optical Fiber Cabling Components Standard
   5. ANSI/TIA-568-C.4, Coaxial Cabling Component Standard
   6. ANSI/TIA-569-C – Commercial Building Standard for Telecommunications Pathways and Spaces.
   7. ANSI/TIA-492.AAAC-B – Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-index Multimode Optical Fibers (OM3/OM4). Current Edition
   8. ANSI/ICEA S-83-596, Fiber Optic Premises Distribution Cable.
   9. ANSI/TIA/EIA-598, Color Coding of Optical Fiber Cables
   10. ANSI/ICEA S-87-640, Fiber Optic Outside Plant Distribution Cable.
   11. ANSI/TIA/EIA-758: Customer-Owned Outside Plant Telecommunications Cabling Standard.
   12. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Single mode Fiber Plant: OFSTP-7.
   13. ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Plant: OFSTP-14A
   14. ANSI/TIA/EIA-TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning
   15. ANSI/TIA/EIA-TSB-140, Additional Guidelines for Field Testing Length, Loss, and Polarity of Optical Fiber Cabling Systems.
   16. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure

17. TIA/EIA-607-B - 2011 - Commercial Building Grounding and Bonding Requirements for Telecommunications
18. Institute of Electrical and Electronic Engineers (IEEE 802.xLAN)
19. TIA/EIA 942 Data Center Standards
20. Current BICSI Telecommunications Distribution Methods Manual
21. NFPA 70 – National Electrical Code (NEC).
22. BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM)

C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes, regulations, and manufacturer installation requirements, then the requirements of these specifications and the drawings shall govern. However, nothing in the drawings or specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

1.4 ABBREVIATIONS

A. The following abbreviations are used in this document:
UTP Unshielded Twisted Pair
SCS Structured Cabling System
RCDD Registered Communications Distribution Designer

1.5 SUBMITTALS

A. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of Notice to Proceed:
1. Proposed circuit routing and circuit grouping plan prepared by a BICSI certified RCDD. The RCDD certification shall have been granted on or before five years previous of proposal due date.
2. Products: Provide standard manufacturer’s cut sheets and/or other descriptive information.
3. Testing: UTP cable test result forms, fiber optic cable test result forms, and a list of instrumentation to be used for systems testing.
4. Provide a line-by-line item specification review indicating compliance or deviation with full description of deviation.
5. Samples: Complete manufacturer’s product literature and samples of patch panel, fiber terminations, and station jacks with cover plate.
6. Provide coordination drawing with IDF/MDF equipment layout and rack elevations for approval, by Owner, prior to installation.

B. Documentation: Contractor shall provide documentation to include test results, and shop drawings. An example of test results as they will be presented should be included with the shop drawings.
1. Work Station Cable Results: The results of the workstation cable tests shall be provided in the form of printouts from the test equipment.
2. Fiber Test Results: Hand written results are not acceptable. Copies of test results are not acceptable. Results to be provided on disk and printed form.

C. Project Completion: As a condition for project acceptance, the Contractor shall submit the following for review and approval:
1. Complete manufacturer’s product literature for all products installed during the course of the Project for Operation & Maintenance.

2. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate8 inspection system to insure that the materials supplied and the work performed conforms to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all connectivity testing was completed and that all irregularities were corrected prior to job completion.
3. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. Provide three printed (3) copies.
4. As-built Drawings shall include equipment layout and rack elevations. The as-built drawings shall be prepared using Auto Cad 2014 electronic format or later on CD.

D. Bill of Materials: The contractor shall provide an itemized pricing breakdown for the turnkey solution that includes: labor, materials, wiring, termination, electrical equipment, electrical hardware, installation, etc. Pricing breakdown shall include the list price for each item provided.

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications.

B. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:

CM Communications Cable
CMP Plenum Rated Communications Cable
CMR Riser-Rated Communications Cable
OSP Outside Plant Cable

C. Initial Cable Inspection: The contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.

D. Cable Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.

2.02 ACCEPTABLE MANUFACTURERS

A. Horizontal Cabling Systems:
1. Leviton/Berk-Tek
2. Commscope Systimax
3. Commscope Uniprise
4. Belden
5. Hubbell

B. Backbone Cabling Systems:
   1. Leviton/Berk-Tek
   2. Commscope Systimax
   3. Commscope Uniprise
   4. Belden
   5. Hubbell
   6. Corning

C. Above-Ceiling Support Systems:
   1. Tomarco CEAS
   2. Panduit
   3. Caddy
   4. Arlington

D. Head-End Systems:
   1. Chatsworth (CPI)
   2. Commscope
   3. Hoffman
   4. Belden
   5. Hubbell

E. Structured Media Enclosure
   1. Primex

2.03 PERFORMANCE REQUIREMENTS

A. Horizontal Cabling Systems
   1. Cable:
      a. The Structured Cabling System provided shall be unshielded twisted pair, four-pair, solid copper conductor, meeting the intent and quality level of the TIA/EIA-568 Commercial Building Wiring Standard.
      b. Building cabling shall be rated CMP. Unit cabling shall be CMR.
   2. Jacks:
      a. Flush mount jacks shall be high quality 8p 8c modular jacks with circuit board construction and IDC style or 110-style wire, T568B terminations (verify with Owner). Jacks shall meet EIA/TIA TSB40 recommendations for connecting hardware.
      b. Shall be standard 8-position, RJ-45 Style, FCC compliant
      c. Shall be designed for 4-pair, 100 Ohm balanced UTP Cable
      d. Shall terminate 26-22 AWG solid or stranded conductors
      e. Shall accept FCC compliant 6 position plugs.
      f. Shall have attached wiring instruction labels to permit either T568A or T568B wiring configurations.
      g. Shall be backward compatible with existing Category 3, 5 and 5E cabling systems for fit, form and function
      h. Shall meet or exceed transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA-568-C2, Transmission Performance Specifications for 4-Pair 100 Ohm.
      i. Shall be UL Listed and CSA certified.
      j. Each jack shall have category rating identified on the front face.
      k. Shall be Category 6
   3. Patch Cords
      a. Shall be factory terminated, with strain-relief boot
      b. Shall match manufacturer of horizontal cabling system

c. Shall be Category 6
d. Patch Cables shall be provided by Contractor for each station outlet and each patch panel jack (i.e. 2 cables per drop/tie cable). Patch cables shall be pinned per EIA 568B and shall be terminated with 8p8c non-keyed plugs at both ends. Patch cords shall be a length suitable to neatly run from farthest two jacks on patch panel and still provide slack to dress cable.

4. Faceplates
   a. Minimum two (2) ports
   b. Blank insert covers shall be provided for unused workstation ports.
   c. Wall mount phone faceplate
   d. Provide 106-Style frame for floor-mounted boxes
   e. Faceplates shall be compatible with standard NEMA openings and boxes.
   f. Faceplates shall be UL Listed and CSA Certified

5. Cabling Support Systems
   a. J-Hooks or Saddle Bags
      i. Hold up to 5” diameter bundle of cable without sagging, bending or damaging cable
      ii. All Velcro used above ceilings must be rated CMP

6. Labels
   a. Labels: The Contractor shall label all outlets using permanent machine engraved labels approved by the Owner. Label patch panels in the wiring closet to match those on corresponding data outlets. The font shall be at least one-eighth inch (1/8”) in height, block. All labels shall correspond to as-builts and to final test reports.
   b. Contractor shall ensure complete durable laser printable cable labels typed labeling of all outlets and cables with numbers that correspond to locations on the punch down block. Labeling system shall correspond to the Owner’s labeling system. Verify with Owner. Provide tags (black letters on white labels, plastic coated) on all cables and outlets.
      i. Durable laser printable cable labels.
      ii. Designed to function in most desktop laser printers.
      iii. Durable Polyester label stock.
      iv. Self -Laminating wrap around design.
      v. Available in US letter sheet size of 8.5" x 11".
      vi. Clear Polyester with White and Colored Print-on areas.
      vii. Polyester rated for 0F to 275F for indoor and outdoor applications.
      viii. Patch Panel Port Identification.
      ix. Face Plate and Port Labels.
      x. 110 & NS6-110 Cross Connect Labels
      xi. Rack and Cabinet Labels.
      xii. Fiber Adapter Labels.
      xiii. Pre-Printed Port Labeling.

7. Structured Media Enclosures
   a. H: 42" / W" 14" / D: 3.5"
   b. Modules shall include
      i. Eight Port RJ-45
      ii. Coax splitter
      iii. Universal Mounting System

B. Backbone Cabling Systems
   1. Fiber:
      a. Physical Characteristics;
         i. Shall be suitable for use in indoors or in indoor/outdoor applications.

ii. Appropriately flame rated optical cable shall be suitable for use in risers, plenums and horizontal applications.
iii. Plenum rated optical cables shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating. Riser rated optical cables shall have and be marked with an UL-OFNR and OFN FT4 Flame Rating
iv. Shall comply with the requirements of ICEA S-83-596 (Premises), ICEA S-104-696 (I/O), or ANSI/ICEA S-87-640 (Outside Plant, OSP).
v. Suitable for underground or aboveground conduits.
vi. Optical cables and fibers shall be color coded in accordance with EIA/TIA-598-C.
vii. Shall have a ripcord for overall jacket.
viii. Shall have armored jacket

b. OS2 Performance Characteristics;
c. i. Dispersion - unshifted single mode optical fibers with Low Water Peak complying with ITU-T G.652.D and with improved bending loss complying with ITU-T G.657.A1.
ii. The zero dispersion wavelength shall be between 1300 nm and 1320 nm. The ANSI/EIA/TIA-455-168 maximum value of the dispersion slope shall be no greater than 0.090 ps/km-nm2. Dispersion measurements shall be made in accordance with ANSI/EIA/TIA-455-169 or ANSI/EIA/TIA-455-175-B.
iii. The nominal mode field diameter shall be 9.2 μm with a tolerance of ± 0.4 μm at 1310 nm when measured in accordance with ANSI/EIA/TIA-455-191-B.
iv. Transmission Characteristics:
v. Maximum cabled attenuation for loose tube fibers shall be 0.4/0.3 dB/km @ 1310/1550 nm.
vi. Maximum cabled attenuation for tight buffer fibers shall be 0.7/0.7 dB/km @ 1310/1550 nm.
vii. The cabled cutoff wavelength shall be ≤1260 nm when measured in accordance with ANSI/EIA/TIA-455-80-C

2. Backbone Copper:
a. 25-Pair Category 3
b. Coax Copper for Riser:
1) For distances 50m or less provide RG-6
2) For distances 50m to 75m provide RG11
3) For distances 75m or greater provide .5” trunk cable.

C. Head-End Systems
1. Racks/Grounding
a. Racks
i. 7’ Tall
ii. Black
b. Patch Panels
i. Modular
ii. Angled
iii. 24/48-Port
c. Ladder Rack
i. Black
ii. 12” Wide
d. Vertical Wire Managers
i. Black
ii. 6”/10” Sizes
iii. Double-Sided
e. Grounding

i. #6 AWG copper grounding wire
ii. 12” grounding bus bar, TMGB pattern
iii. 2-hole grounding lugs

2. Fiber Head-End Systems
   a. Fiber LIU
      i. 4RU – MDF
      ii. 2RU - IDF
   b. Bulkheads
      i. 12-Port Duplex
      ii. LC
   c. Connectors
      i. LC
   d. Patch Cords
      i. 3-Meter
      ii. LC-LC terminations

PART 3 - EXECUTION

3.1 GENERAL

A. At completion the horizontal cabling system shall be inclusive of Cat (5e/6), jacks, faceplates, patch cords, above-ceiling supports, labels, testing, and all supporting equipment to provide a complete solution as described in this specification.

B. At completion the backbone cabling system shall be inclusive of fiber, multi-pair copper, connectors, bulkheads, patch cords, above-ceiling supports, testing, and all supporting equipment to provide a complete solution as described in this specification.

C. At completion the head-end system shall be inclusive of 2-post racks, patch panels, fiber termination boxes, wire managers, ladder rack, fire-rated plywood, power-strips, grounding and all supporting equipment to provide a complete solution as described in this specification.

D. Conformance to the installation practices covered above is to be verified when completed. In some cases, the Owner/Engineer may observe before acceptance.

E. All clean-up activity related to work performed shall be the responsibility of the contractor and shall be completed daily before leaving the facility.

3.2 EXISTING CONDITIONS

A. It is encouraged that the contractor be familiar with the site and existing district infrastructure before submitting proposal. Congested building areas shall be inspected by the contractor to ensure coordination with the other trades during construction. No extras shall be permitted because of the contractor’s failure to properly investigate existing conditions or building design at the time of the proposal.

B. The Contractor shall coordinate with other system vendors, where appropriate, to facilitate equipment installation, scheduling, protection of equipment and access to the project site in order to provide the Owner a substantially complete project in a timely manner.

3.3 HORIZONTAL CABLING

A. Colors/Types
   1. Cable
      a. Blue
   2. Jacks/Patch Cords
      a. Data – Yellow
      b. VoIP – Orange
      c. Wireless Access Points – Blue
      d. Security – Green
      e. POT – Gray
      f. Building Automation – Red
      g. Audio/Video – White
      h. Management – Black

   3. Faceplates
      a. Coordinate with Division 26

B. Installation
   1. Horizontal Cabling
      a. One (1) cable shall be provided for each port shown on the drawings, unless otherwise shown on drawings. The SCS shall serve as a vehicle for transport of data, video and telephony signals throughout the network from designated demarcation points to outlets located at various desk, workstation and other locations as indicated on the contract drawings and described herein. Applications standards supported should include, but be not limited to, IEEE 802.3, 10Base5, 10BASE-T, IEEE 802.5, 4 Mbps, 16Mbps 328 ft. [100m], and TP-PMD. In addition, these links/channels shall be capable of supporting applications such as 100 Base-T and 52/155 Mbps ATM AND 77 Channel Analog Broadband Video to 550 Mhz. Gigabit cable performance shall be capable of supporting applications including AES/EBU Digital Audio, 270 Mbps Digital video, 622 Mbps 64-CAP ATM, 1000BASE-T Gigabit Ethernet and 1.2 Gigabit ATM.
      b. The cabling shall be installed per requirements of the manufacturer and the Project Documents, utilizing material meeting all applicable TIA/EIA standards. The contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.
      c. Cable shall not run in close proximity (6 inches' perpendicular, 12 inches parallel) to power conduits (and other electrical noise sources). No patch panel, cable, outlet or punch block shall be within 6 feet of transformers or 12 inches of fluorescent lights, light fixtures, A/C wiring, radio systems or any other RF emitting device in ceilings or in/on walls.
      d. Furnish and install pull strings in all new conduits, including all conduits with cable installed as part of this contract. Pull test is not to exceed 200 pounds.
      e. Conduit sleeves shall be provided from outside IDF/MDF location to below ceiling area above ladder rack inside IDF/MDF. Minimum conduit size for data cabling sleeves shall be 4 inch.
      f. Any data cabling installed in any conduit that is run underground in or under building slab shall be outside plant rated and sealed at each end with approved gel cable/conduit sealant.
      g. Cable runs shall be free of splices, kinks, excessive slack, and damage to the

outer jacket

h. Cables shall not be painted.

i. Cables shall be placed with sufficient bending radius so as not to kink, shear or damage the cable jacket or to otherwise diminish the transmission capability of the wire inside.

j. Cable and/or cable bundles shall not be attached to any electrical wiring or light fixtures, nor will its vertical deflection allow it to come in contact with HVAC mechanical equipment, electrical wiring, conduits, piping, or fluorescent light fixtures.

k. All data cables shall be home runs from outlet at final termination to patch panel at IDF/MDF.

l. Cable Termination:
   i. Number of twists per foot shall be maintained all the way to cable termination point.
   ii. Provide three (3) foot service loop above ceiling for each drop, on workstation and head-end side
   iii. Cable shall be terminated using tools specified by the cable manufacturer.

m. If there is no IDF/MDF within 90-meter cable limitations of drop, contractor shall be responsible for additional IDFs as required for a complete system. Locate additional IDFs in Mechanical/ Electrical Rooms or as directed by Owner. Provide additional 120-volt power and receptacles as required for additional IDF locations, similar to those IDFs indicated or specified elsewhere.

n. Cable Supports:
   i. In suspended ceiling and raised floor areas where duct, cable trays or conduit are not available, the Contractor shall bundle, in bundles of 50 or less, station wiring with cable ties snug, but not deforming the cable geometry. Cable bundles shall be supported and attached to the building structure and framework at a maximum of five (5) foot intervals.
   ii. Cables shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
   iii. Cables shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space.

o. Fire Wall Penetrations: The Contractor shall avoid penetration of fire rated walls and floors wherever possible. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.

p. Wall Penetrations: Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.

q. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.

r. Mounting heights shall conform to the Local Building Code Accessibility Standards. Mounting height shall match adjacent wiring devices unless noted otherwise.

s. Two (2) duplex receptacle(s) shall be installed at all IDF locations and circuited to the nearest computer power panel board. Coordinate with Division 26.

t. Contractor shall not hang cabling on pipes or wiring looms. Provide and install separate J-Hooks, cable saddles or cable trays to carry cable plant that is installed. Cable support shall be secured to building structure.

u. Cable shall run parallel and perpendicular to building lines. Changes in direction will be made with smooth bends, not exceeding minimum bend radius.

v. Emergency phone copper –Shall be provided, at minimum, at the following locations, coordinate with drawings:
   i. Emergency phone locations.
   ii. Elevator Machine Room
   iii. Building Management Control Panel.

iv. Security System.
v. Fire Alarm Panel

w. Wireless Access Points:
i. Install each outlet above ceiling in biscuit style termination of same design as station hardware

x. Security Cameras:
i. Install each outlet above ceiling in biscuit style termination of same design as station hardware.

y. Damage:
i. The Contractor shall replace or rework cable showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and excessive cable sheath has been removed.
ii. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation. Ceiling tiles shall match existing or new as specified elsewhere.

3.4 BACKBONE CABLING

A. Colors
1. Fiber:
a. OS2 – Yellow
2. Backbone Copper
b. Cat 3 – Gray
c. Coax - Black

B. Installation
1. Fiber:
a. Furnish and install 12-Strand OS2 Fiber Between MDF and each corresponding IDF, on each floor with an LMC Building IDF
b. Furnish and install factory terminated LC connectors, quantity to match number of strands installed.
c. Furnish and install quantity one (1) 3- meter LC-LC patch cord, factory terminated, for every 2-strands installed.
2. Copper Backbone:
d. Furnish and install quantity one (1) – 25-Pair on each floor with an LMC Building IDF
e. Furnish and install quantity of connectors necessary to terminate one pair per port, on both sides.
f. Furnish and install quantity (1) patch cord for each connector provided.
g. Furnish and install 24-Port Patch Panel in each closet for termination of backbone copper.
3. Conduits:
a. Furnish and install (4) 4” conduits from the building MDF to each of the unit residential floor data closets. These are to be used for provider cabling.
b. Furnish and install (2) 4: conduits from the building MDF to each of the building IDFs for LMC backbone connectivity.

3.05 HEAD-END SYSTEMS

A. Installation

1. Furnish and install (3) 2-Post Data Racks in the building MDF.

a. Furnish and install all hardware necessary to ensure proper grounding and cable management.

2. Furnish and install (1) 2-Post rack in each building IDF and residential floor data closet.
   a. Furnish and install all hardware necessary to ensure proper grounding and cable management.
3. Backboard: Furnish and install an equipment backboard at each IDF equipment location. Backboard shall be ¾" x 8' x 4' Grade A fire retardant plywood, with fire retardant paint. Coordinate placement of all equipment with Owner
4. Wire Management Components: Vertical cable management panels shall be installed on each side of the rack. In instances where more than one rack is installed in a single location, vertical cable management shall be installed between the racks.
5. Cable Placement: Cable installation in the wiring closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.
6. Cable shall be routed as closely as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the wiring closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment. All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels.

3.06 HORIZONTAL & BACKBONE CABLE TESTING/LABELING

A. Notification: The Owner/Architect/Engineer shall be notified one week prior to any testing so that the testing may be witnessed.

B. Final Acceptance: Before requesting a final acceptance, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.

C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation shall be evaluated in the context of each of these factors.

D. Errors: When errors are found, the source of each error shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Retest results must be entered on the test results form. All corrections shall be made prior to final acceptance test.

E. Twisted Pair Cable Testing

1. At a minimum, the Contractor shall test all station drop cable pairs from data closet termination patch panel port to station insert. Products shall be tested for compliance to ANSI/TIA/EIA 568 and ISO/IEC 11801 for a rated installation. Test equipment used shall meet TIA/EIA TSB-67, Level 4 accuracy. Further, the Contractor shall have a copy of TSB-67 in their possession and be familiar with its contents. Testing shall be against either appropriate category standards or the manufacturer's specifications whichever is

more stringent and applicable.

2. Each wire/pair shall be tested at both ends for the following:
    a. Wire map (pin to pin connectivity)
    b. Length (in feet)
    c. Attenuation
    d. Near End Cross Talk (NEXT)
    e. Power Sum
    f. Structural Return Loss
    g. Delay Skew
    h. PSNEXT
    i. ACR
    j. PSACR
    k. Equal Level Far End Crosstalk (ELFEXT)
    l. PSELFEXT
    m. Far End Crosstalk (FEXT)
    n. Propagation Delay
3. Test equipment shall provide an electronic and printed record of these tests. Test equipment calibration documentation shall be available for on-site inspection.
4. Test results of each four-pair UTP cable must be submitted with identification to match labels on all patch panel ports and 8p8c jacks and must match as-builts associated with that cable.

F. Fiber Optic Cable Testing
1. Testing device for fiber optic cables shall be a high quality OTDR (Optical Time-Domain Reflectometer) equipped with a printer. The printed data shall show, in addition to any summary information, the complete test trace and all relevant scale settings. The OTDR must have the capability to take measurements from bare fiber strands as well as ST or SC connector terminations.
2. All fiber optic cable shall be tested on the reel before installation to ensure that it meets the specifications outlined herein.
3. After installation, the Contractor shall test each intra-building fiber strand with a power meter in accordance with EIA 455-171 Method D procedures (bi-directional testing) at both 850 and 1300 nm. A form shall be completed for each cable showing data recorded for each strand including length, total segment (end to end) loss (dB) and connector losses (dB) at each end. In addition, the printed data strip for each strand shall be attached to the form. Patch cables shall also be tested.
4. Acceptable fiber optic cable and connector loss shall not exceed 1.5 dB. The Contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer specifications.

G. Acceptance of the Data Communications Cabling System shall be based on the results of testing, functionality, and the receipt of documentation. With regard to testing, all fiber segments and all workstation data cables must meet the criteria specified. With regard to functionality, the contractor must demonstrate to the Owner that 100 Base-T data signals can be successfully transmitted, bi-directionally, from the MDF and from some number of individual data outlets. The number of outlet locations to be tested shall be determined by the Owner.

H. Coordinate with Architect and Owner's Information Systems Department the required SCS identification prior to construction. Exact nomenclature for identification shall be submitted in writing to the Architect for review prior to final identification.

I. Cable Drop Label Nomenclature:
1. Each port shall be identified; verify exact nomenclature with Owner.
2. Each port on the “front” or facing side of each patch panel shall be identified.
3. Each patch panel or “blade” shall be identified on the “front” or facing side.

4. In each rack, numbering shall begin the upper left patch panel (as viewed from the “front” of the patch panels), extending down vertically through each rack’s complement of patch panels, and sequencing to the upper patch panel in the next adjacent rack.
5. All data cable jackets should be labeled at both terminations:
    a. Cable end at faceplate termination should be labeled to match faceplate designation.
    b. Cable end at IDF/patch panel termination should be labeled to match back port designation on patch panel.
6. Label fiber on each IDF and MDF patch panel. Label in a manner that designates clearly which IDF they are originating from and where they are going - i.e. From IDF#__ to Room #___ or to MDF Room # ___.

3.7 WARRANTY

A. The Product Warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s).

B. A twenty (20) year extended product warranty and application assurance for this structured cabling system shall be provided as follows:
    1. The extended product warranty shall ensure against product defects, that all approved cabling components exceed the specifications of TIA/EIA 568 and ISO/IEC IS 11801, exceed the attenuation and NEXT requirements of TIA/EIA TSB 67 and ISO/IEC IS 11801 for cabling links/channels, that the installation shall exceed the loss and bandwidth requirements of TIA/EIA TSB 67 and ISO/IEC IS 11801 for fiber links/channels. The warranty shall apply to all passive SCS components.

C. The extended warranty application assurance shall cover the failure of the wiring system to support the application which it was designed to support by recognized standards or user forums that use the ITA/EIA 568 or ISO/IEC IS 11801 component and link / channel specifications for cabling, for a twenty (20) year period.

D. Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a numbered certificate, from the manufacturing company, registering the installation.

END OF SECTION 271000

SECTION 27 40 00 - AUDIOVISUAL SYSTEMS

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. General Information for Audiovisual Systems
2. Audiovisual standard equipment requirement
3. Audiovisual Function Summaries for typical room types

B. Related sections include:
1. 27 00 00 Communications Systems
2. 28 00 00 Security Systems

C. References for standards, certifications and best practices from all relevant sections or chapters shall apply to this project:
1. ADA: Americans with Disabilities Act
2. AHJ: Local Authority Having Jurisdiction including local laws and labor regulations
3. AIA: American Institute of Architects
4. ANSI: American National Standards Institute
5. ASIS: ASIS International
6. ASTM: American Section of the International Association of Testing Materials
7. AVIXA: Audiovisual and Integrated Experience Association
8. BISCI: Building Industry Consulting Services International
9. EIA: Electronic Industries Alliance
10. FCC: Federal Communications Commission
11. IBC: International Building Code (including local code amendments)
12. IEEE: Institute of Electrical and Electronics Engineers
13. ISO: International Organization for Standardization
14. NEC: National Electric Code (including local code amendments)
15. NFPA: National Fire Protection Association
16. OSHA: Occupational Health and Safety Association
17. TIA: Telecommunications Industry Alliance
18. UL: Underwriters Laboratories
19. For any instance that multiple organizations provide direction on a specific scope, the strictest guideline shall be followed.

1.3 QUALITY ASSURANCE & QUALIFICATIONS

A. Carefully examine the drawings, specifications, visit the site and become familiar with the local conditions relating to the work.

B. Discovery of any conflicting design information or any design intentions which are not readily interpreted shall be referred to the engineer for further description or illustration prior to any product selection or execution of work.

C. Discovery of any materials or equipment which are damaged, unsuitable, incompatible, or non-compliant with applicable codes, laws, ordinances, or regulations shall be brought to the direct attention of the engineer.

D. **Manufacturer**: Company specializing in the manufacturing of the products specified in this section with a minimum of seven years of documented experience, ISO 9001 or equal certification, and with facilities within 100 miles of the project location. Identify country of origin of all products. Products manufactured in the USA are preferred. All products must be listed by a nationally recognized testing agency UL, ETL or equal.

E. **Supplier**: Authorized distributor of specified manufacturer with a minimum of ten years documented experience with local stock for service and maintenance of specified components.

F. **Installer**: Company specialized in the installation of the products specified with a minimum of five years of documented experience and three project of similar size and scope within the past 24-months.

G. **Servicing**: Authorized factory-trained fulltime staffed service department with a minimum of five years of documented experience specializing in the servicing of the products specified with service facilities within 50 miles of the project.

H. **Certified Dealers**: The prime contractor must be certified by the manufacturer to furnish, install, and service all specified products.

I. **Insurance**: Must be insured to the requirements set at the greatest extent of the building owner, landlord, general contractor or client.

J. **Certified Practitioners**: At least two full time staff members assigned to the project team must be certified in by AVIXA with one being CTS-I and another CTS-D.

1.4 SUBMITTALS

A. Submit under provisions of Division 1 for each phase of submittal as follows:

B. Proposal
1. Written Proposal: narrative scope of work.
2. Equipment List: manufacturers, models, quantities.
3. Pricing Breakdown: labor, materials, tax, permit for each system
4. Unit Pricing: typical location for each standard symbol on the drawing including equipment, cabling, and installation labor.
5. Product Cut Sheets: for all substituted products.
6. Certifications: provide copies of manufacturer certifications for all products proposed within the project scope.
7. Extended Warranty: pricing for extending the full warranty period from 12-months to 60-months on an annual basis with recommended preventative maintenance visits included.
8. Insurance: certificate provided with the project named.
9. References: provided with contact name, phone number and email for three projects of similar size and scope completed within the past three years.
10. Project Team: organizational chart with applicable certifications for all team members to be assigned to the project.

C. Project Kickoff
1. Mock-up Submittal: of physical samples for client approval with faceplate colors and labels, jack colors, and cable colors and labels.
2. Product Data: for all products, equipment, cabling, and materials proposed to be installed on the project. All be approved prior to ordering.
3. Shop Drawings: submittal containing dimensioned installation drawings for all components with interconnection details and required sequence of operations.
4. Seismic Qualification Certificates: as required by local jurisdiction.

D. Project Close Out

1. Test Reports: indicating satisfactory completion of tests and inspections required by this specification and the standards referenced herein.
2. Manufacturer's Instructions: indicating application conditions and limitations of the use stipulated by product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
3. Record Documents: of actual locations of equipment, devices, and interconnecting wiring with field identifying labels. Provide one laminated copy to be hung at each head end or rack location.
4. Letter of Warranty: with contact information for service and support.
5. Extended Warranty: of manufacturer's extended warranty of products.
6. Maintenance Data: including instructions for safe operating procedures, replacement parts, and troubleshooting diagnostics.
7. Ownership of Code: all customized software/code must be handed over to the owner at the completion of the project in without any encryption or passwords.

1.5 PROJECT CONDITIONS

A. Environmental considerations shall be made during every phase of the project. This includes recycling and limiting of waste on the project. Refer to LEED project manager is additional requirements exist for this project.

B. Existing conditions must be reviewed prior to commencing work. Refer to separate sections and notes within the specifications and drawings for special requirements of existing locations, materials, and equipment.

C. Field Measurements must be confirmed by the installer. All drawing backgrounds and models are issued to scale as received by others. Incorrect takeoff measurements are the responsibility of the installer.

D. All finished work by other trades or existing conditions must be protected from damage by the installer. The installer is liable for any costs to repair or replace damage caused.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Protect from moisture by using appropriate coverings. Store in dry interior locations.

B. Do not install until building is closed in and suitable temperature conditions are controlled.

C. Maintain suitable temperature and humidity conditions during and after installation of cabling and equipment.

D. Provide protection of all installed components until after all carpet, furniture, and painting is complete.

E. Only deliver equipment to the project location upon verification that the site is secure and safe. All materials and equipment are the responsibility of the contractor until accepted by the client at project completion.

1.7 WARRANTY AND SERVICE

A. Upon substantial completion of the project, a full 12-month labor, workmanship, and material warranty shall apply to all new components.

B. The cabling system shall be warranted labor and materials for no less than 15-years by the manufacturer.

C. During the 12-month warranty period, the installer shall replace defective or malfunctioning items subjected to normal use at no cost to the owner within a 24-hour period.

D. Within the period 90-180 days after the turnover of the project, the installer shall visit the site to verify all components are satisfactory to the client and all systems are performing as designed. At this time, service packs and firmware shall be updated while additional training provided.

E. SLA: service level agreement must be provided by the installer for the warranty period:

Working Hours (M-F 8AM – 5PM)

Live Person Telephone Response within 1-hour
On-Site Support within 4-hours

Non-Working Hour (M-F 5PM – 8AM and Weekends)

Live Person Telephone Response within 4-hours
On-Site Support next business day

PART 2 - PRODUCTS

2.1 GENERAL

A. This section identifies a basis of design with a single manufacturer. Additional manufacturers as listed are acceptable.

B. Equipment and devices shall be a standard system certified end-to-end.

2.2 CONDITION

A. All products shall be new unless specifically called out otherwise.

2.3 ACCESS AND CUSTOMIZATION

A. All products shall be standard off the shelf products readily available.

2.4 DISPLAYS AND PROJECT DEVICES

A. All displays shall be provided commercially rated or with an extended warranty to be used in a commercial environment.

B. All displays shall be rated for use 16-hours per day, 7-days per week unless noted otherwise.

C. Final field coordination of flat panels, projectors, screens, touch panels, or other display technology shall be completed by the AV installer.

2.5 EQUIPMENT SCHEDULES

A. Major components are included in the equipment schedules. The installer is required to provide any additional components necessary to provide a fully functional system.

B. Equipment Schedules to be noted on the drawings.

2.6 ALTERNATES

A. All components reference a specific manufacturer and model number or series. Any installer desired alternates may be accepted if proof of the equivalent specification is provided. Additional detail on alternates is provided with the equipment schedules.

2.7 EXTRA MATERIAL

A. Submit extra materials under provisions of Division 01.

B. Furnish additional components as called out in the equipment schedules.

PART 3 - EXECUTION

3.1 GENERAL

A. All installation shall be completed in a neat, efficient, and workmanlike manner.

B. Do not install equipment and materials that have not been submitted to, reviewed and approved by the Engineer.

C. All installation shall be completed in accordance with manufacturer's recommendation and industry best practices.

D. All installation shall take place only after full coordination is completed.

E. Site Observation
1. The engineer shall perform site observations throughout the project.
2. Reports generated from observations shall notify installers of issues and deficiencies.
3. The installer shall notify the engineer at least ten days prior to closing walls, ceilings, and raised floor, etc. to ensure inspections can be completed.

F. Change Orders, Modifications, Revisions and Directives:
1. When revisions are made to the project with a drawing, sketch or narrative request, a change order must be submitted and approved in accordance with the installer's contract prior to any work commencing - all change orders must include additions and deductions in scope.
2. Change orders must include a full listing of deductions and additions for labor and materials at the same rates proposed on the original contract.
3. Field direction by the owner or engineer shall not be considered approval for any change in scope or cost. All changes to the scope must be presented in a formal change order.
4. Unit costs must be equal for the project duration to adds, changes, and deducts.

3.2 SCOPE DELINEATION

A. Multiple trade scope delineation is identified on the scope delineation table on the drawings.

3.3 FINAL DESIGN

A. The AV installer is required to complete the final design based upon the intent and major components listed herein.

B. All work proposed from these documented shall be complete and fully functional systems.

3.4 CONTROL SYSTEMS AND USER INTERFACE

A. Final user interface shall be verified with the client during the submittal phase for all touch panels, button controllers, and other control elements.

B. The user interface must meet the functionality described in the summary and conform to any known client standards.

C. Custom user interfaces shall follow AVIXA documented best practices and created to be user friendly with minimal training.

3.5 INPUT LOCATION CORDS

A. End user input location cords will not be listed in the equipment list unless it is fixed within a device (cubby, etc.)

B. The installer shall provide a user connection cable for each input location and each input connection type.

3.6 SIGNAL TRANSMISSION

A. All cabling required for the system shall be provided by the AV installer unless noted otherwise.

B. Any network data locations identified to be provided by the Communications installer shall be excluded from the AV installer's scope of work.

C. All cabling shall be certified for the intended purpose and fall within the guidelines of the manufacturer of both ends of equipment.

D. All digital transport encoders, decoders, baluns, or other required active components shall be provided by the AV installer within the base scope of work.

E. All AV and signal transmission exceeding 15-feet shall be converted to a digital UTP cabling system.

3.7 SIGNAL PROCESSING

A. All display native resolutions shall be identified for the client and input shall be scaled to that resolution.

B. The following requirements shall be set a baseline standard for all display devices or separate processing components that may not be listed in the equipment list:
1. Up/Down Scaling: Horizontal, Vertical, and Diagonal averaging
2. De-Interlacing: Motion Adaptive
3. Color Depth: 10-bits
4. Chroma Sampling: 4:4:4
5. Re-Sync: Automatic

3.8 AUDIO

A. For all spaces controlled by digital signal processors, the AV installer must provide full programming, tuning, balancing, and commissioning.

B. Analog, IP, or USB interface shall be confirmed prior to ordering any equipment.

C. Automatic gain shall be configured and a maximum of 6dB noise cancellation used.

D. Microphone muting requirements shall be presented to the client prior to programming for acceptance of standard operating procedures.

3.9 PROJECT MANAGEMENT, SCHEDULE, COORDINATION & SEQUENCING

A. The installer shall provide a single point of contact for the project team for coordination of schedule and interdisciplinary items. The project manager must be technically knowledgeable about the products and systems being provided.

B. The installer shall provide a detailed construction schedule with hard dates for completion of; rough-in, cabling, terminations, testing, programming, commissioning. The project schedule must be completed in a format that can be imported into the master project schedule.

C. Continuity of all service will be maintained in all areas that will be occupied or temporarily relocated during the project.

D. Any service interruption must be scheduled with at least seven days of notice to the owner.

E. Include premium time for any work required to comply with the project schedule.

F. Field Locations: verify locations of outlets, closets, equipment rooms, raceways, etc. prior to rough-in.

G. The installer shall coordinate with the owner, project manager and/or general contractor on the sequencing of the trades required within these documents, supporting these, and required by these for the entire lifecycle of the project.

H. Cooperation and coordination is required with all trades:
   1. The work will be performed so that the progress of the entire project will not be delayed or interfered with.
   2. Keep fully informed as to the shape, size, and position of all openings required for all apparatus and give information in advance to building openings into the space.
   3. Furnish and set in place all sleeves, pockets, supports, and incidentals.
   4. Coordinate exact locations and rough-in dimensions of all work before installation and make all final connections as required.
   5. Attend project coordination meetings to coordinate work of this section, pathways, and work of other trades phasing and project requirements.

I. All furniture devices must be coordinated with the General Contractor, Furniture Vendor, and Owner for size and location of penetrations.

J. Equipment rack space and locations shall be coordinated with the General Contractor and owner.

K. Network and phone requirements must be coordinated 6-weeks prior to system turnover.

3.10 EXAMINATION

A. Verify that the interior of the building has been protected from the weather.

B. Verify that the cable tray system and conduit raceway system is complete and supported.

C. Verify that conduit stubs are installed with bushings.

3.11 PREPARATION

A. Completely and thoroughly swap raceway prior to pulling cable.

B. Prepare all rooms, floors, walls, and furniture to ensure the condition is suitable for the installation of new components.

3.12 ALTERATIONS AND DEMOLITION

A. Refer to drawings for alterations and demolition required.

B. Refer to drawings for equipment reuse.

3.13 CABLING

A. Refer to 27 00 00 for all cabling requirements.

3.14 TESTING

A. All provided scope shall be tested and reported with ah certification from the installer and the date and time the testing took place.

B. All active components shall be tested based upon the designed criteria for the system and a pass/fail test for all features shall be provided.

C. All systems shall be fully commissioned by the installer. Follow the AVIXA standard room commissioning form for each space with AV.

3.15 TRAINING

A. The installer shall provide full end user training of all devices, components, and systems.

B. The training session(s) must be scheduled in advance with a syllabus of all topics.

C. The training must be presented by a factory trained and certified technical expert.

D. Training shall be included at no additional cost to the owner and satisfied upon acceptance and full understanding of the system by the owner.

E. Minimum training components shall include:
1. Review system capabilities and features
2. Review device locations and record drawings
3. Review each system
4. Review each function of each system
5. Identify procedures for all standard owner functions
6. Present advances functions and user customizations as required
7. What to do if something goes wrong

END OF SECTION 274000

SECTION 275223 - NURSE CALL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All work specified in this Section shall comply with the provisions of Section 26 00 00.

1.2 SUMMARY

A. Section includes visual/tone nurse-call system using lamp and electronic tone annunciation at a central annunciator station to register calls from patient to other call-in stations.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment cabinets and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Cabling Diagrams: Single-line block diagrams showing cabling interconnection of all components for this specific equipment. Include cable type for each interconnection.
3. Station Installation Details: For built-in equipment, dimensioned and to scale.

C. Qualification Data: For qualified Installer.

D. Field quality-control reports.

E. Operation and Maintenance Data: For nurse-call equipment to include in emergency, operation, and maintenance manuals.

F. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Compatibility: System shall be capable of integration with any brand of phone system (wired or wireless), staff locating system, CCTV, and fire-alarm system.

C. Electrical Components, Devices, and Accessories: Listed and labeled according to UL 1069 as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace batteries that fail in materials or workmanship within specified warranty period. Special warranty for batteries applies to materials only, on a prorated basis for specified period.

1. Warranty Period: Include the following warranty periods, from date of Substantial Completion:

a. Nickel-Cadmium Batteries, Lithium Batteries, and Wet-Cell Batteries:

1) Full Warranty: 5 years.
2) Pro Rata: 15 years.

1.6 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

B. 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 NURSE-CALL SYSTEM GENERAL REQUIREMENTS

A. Station Zones: Able to program 256 station zones for each master station in the network with eight priority levels and addressable visual and audible annunciation of audible devices such as smoke detectors and door contacts.

B. System shall provide integrated and centralized "Code Blue" and "Staff Emergency" calls.

C. Expansion Capability: Equipment ratings, housing volume, spare keys, switches, relays, annunciator modules, terminals, and cable conductor quantities adequate to increase the number of stations in the future by 25 percent above those indicated without adding internal or external components or main trunk cable conductors.

D. Existing System Compatibility: Functionally and electrically compatible with existing system so components and wiring operate as an extension or upgrade of the existing system and existing or upgraded functional performance of the existing system applies to the entire final system. Colors, tones, types, and durations of signal manifestation shall be common among new and existing systems.

E. Resistance to Electrostatic Discharge: System, components, and cabling, and the selection, arrangement, and connection of materials and circuits, shall be protected against damage or

diminished performance when subjected to electrostatic discharges of up to 25,000 V in an environment with a relative humidity of 20 percent or less.

F. Equipment: Microprocessor, electronic, modular.

G. Master Nurse-Call Station: Programmed via a PC.

H. Wall-Mounted Component Connection Method: Components connect to system wiring in back boxes with factory-wired plug connectors.

I. Telephone Interface: Permit use of wired and wireless telephones to execute nurse-call master station functions.

J. Third-Party Pager Interface: Programmable to send tone, numeric, and alphanumeric message to pocket pagers or personal digital assistants and to use industry standard-protocol, RS-485 interface.

2.2 VISUAL/TONE NURSE-CALL SYSTEM

A. Basis-of-Design Product:
1. Jeron Electronic Systems, Inc. – Provider 680
2. Rauland-Borg Corporation – Responder IV

B. Operational Requirements:

1. Patient Station Call: Lights a steady call-placed lamp on the station, steady lamps in the zone light and corridor dome light associated with the patient's room, and steady lamps at the central annunciator and other system display devices and displays message on master and staff/duty stations. At the same time, it sounds a programmed tone at intervals, at the respective annunciator and master and staff/duty stations. Legends at the central annunciator and master station identify the calling station.
2. Pull-Cord-Call Station Call: Flashes a call-placed lamp on the station and distinctive-color lamps in the zone light and corridor dome light and at the central annunciator and staff/duty stations. At the same time, it sounds a programmed tone at intervals, at the central annunciator and master and staff/duty stations. A legend at the master station identifies the calling station, priority as programmed, and bed identification.
3. Emergency-Call Station Call: Produces the same responses as pull-cord-call station calls except rapidly flashing red emergency digital display and tone repetition rates are more frequent, tone frequency is higher, and lamps in the zone light and corridor dome light are a different color. Indicator lamps may be extinguished, and the system reset only at the calling station. Displays message on pocket pagers, sounds programmed tone on phones, and displays message on display equipped phones.
4. System Reset: Operating reset button at the originating station cancels signals associated with the call. Illuminates a green digital display on the patient station and log presence on the master station.
5. Cord-Set Removal: Initiates a patient station call when the cord set is removed from the jack in the patient station faceplate. Displays location and "cord removed" message on master station, pocket pagers, and display equipped phones. Inserting a cord-set plug or a dummy plug into the jack and operating the station reset button resets the call.
6. Patient Control Unit: Controls entertainment volume and channel selection. Nurse button on the unit initiates a patient station call. Integral speaker reproduces entertainment sound.

7. Emergency Bath Station Call: Illuminates the digital display on the emergency bath station; rapidly flashes white dome lamp; displays location, priority, and bath on master station; and sounds programmed tone on master station display equipped phones and pocket pagers.

C. Central Annunciator:

1. Lamp type.
2. Lamp Legends: Machine lettered and legible from a distance of at least 48 inches when a call is present. Legend shall identify initiating station and priority of call.
3. Power-on Indicator: Digital, or push-to-test switch.
4. Audible Signal: Electronic tone.

D. Central Equipment Cabinet:

1. Lockable metal.
2. Houses power supplies, controls, terminal strips, and other components.
3. Power-on indicator lamp.
4. Battery Backup Unit: Sealed nickel-cadmium, wet-cell battery supplies power through an automatic switch when normal power fails, for a period of not less than six minutes at rated output. System shall lose no unanswered calls or calls in progress during the transfer operation.

a. Automatic retransfer to normal power, after a 15-minute time delay.
b. Two-rate battery charger with an automatic trickle rate and a recharge rate.

E. Single-Patient Station: Call-placed lamp, reset push button, and polarized receptacle matching cord-set plug; mounted in a single faceplate.

F. Dual-Patient Station: Single call-placed lamp, single reset push button, and two polarized receptacles matching cord-set plug; mounted in a single faceplate.

G. Ambulatory-Patient Station: Call push-button switch, call-placed lamp, and reset push button; mounted in a single faceplate.

H. Staff/Duty Stations: A minimum of two call lamps, one for routine calls and one for emergency calls; and an audible tone signal device.

2.3 SYSTEM COMPONENTS

A. Emergency-Call Station: Locking-type push button, labeled "Push to Call Help"; reset trigger to release push button and cancel call; and call-placed lamp, mounted in a single faceplate.

B. Emergency-Bath Station:

1. Consists of a sliding, chemical-resistant, ABS red fascia marked with the word "URGENT" in bold letters.
2. Capable of being activated with nylon pull cord or by sliding the face of the unit downwards.
3. Activation of the station shall illuminate a reassurance digital display on the face of the unit in addition to notifying the master station.
4. Water resistant and able to withstand routine cleaning and chemical disinfectants.

5. Uses magnetic reed switch technology for reliability and corrosion resistance.
6. Mounts on a single-gang electrical box wire to the respective patient station or input controller.

C. Pull-Cord-Call Station:

1. Pull-Down Switch: Lever-locking type, labeled "Pull Down to Call Help."
2. Reset trigger.
3. Call-placed lamp.
4. Water-resistant construction.

D. Patient Control Unit:

1. Equipped with plug and 96-inch long white cord.
2. Ethylene oxide, sterilizable.
3. Light-Control Switch: Arranged for independent on-off control of patient's up and down light.
4. Integral Speaker: 2 inches, with 0.35-oz. magnet, rated 0.2 W.
5. Controls: Speaker volume, TV control, and nurse call.
6. Housing: High-impact white plastic.
7. Attachment: Stainless-steel bed clamp with permanently attached polyester film strap.
8. Quantity: 12 units for every 10 patient beds.

E. Call-Button Cord Set:

1. Plug and 72-inch white cord; cord set shall be resistant to medical gas environment equipped with momentary-action, call-button switch.
2. Ethylene oxide, sterilizable.
3. Washable cord.
4. Palladium switch contacts in high-impact white housing with cord-set strain relief.
5. Attachment: Stainless-steel bed clamp with permanently attached polyester film strap.
6. Quantity: Three cord sets for every 10 patient beds.

F. Pillow Speakers:

1. Eight-conductor, DIN, flexible PVC jacketed cable.
2. Contain nurse-call button, volume control, speaker, and channel control in molded flame-retardant ABS housing.
3. Cord: 96 inches long with sheet clip.

G. Call-Button Plug:

1. Designed to plug into patient station cord-set receptacle.
2. Button switches call circuit.
3. Two plugs for every 10 patient beds.

H. Indicator Lamps: Digital type with rated life of 20 years unless otherwise indicated.

I. Corridor Dome Lights and Zone Lights:

1. Three-lamp signal lights.
2. Lamps: Front replaceable without tools, low voltage with rated life of 7500 hours. Barriers are such that only one color is displayed at a time.

3. Lenses: Heat-resistant, shatterproof, translucent polymer that will not deform, discolor, or craze when exposed to hospital cleaning agents.
4. Filters: Two per unit, amber and red.

J. Cable:

1. Conductors: Jacketed single and multiple, twisted-pair copper cables.
2. Sizes and Types: As recommended by equipment manufacturer.
3. Cable for Use in Plenums: Listed and labeled for plenum installation.

K. Grounding Components: Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems."

2.4 SOFTWARE REQUIREMENTS

A. Telephone System Interface:

1. Permits use of wired and/or wireless telephones to execute nurse-call master station.
2. Two-way communication with patient and staff stations.
3. Two-way communication with the master nurse station.
4. "All Call," group call, and staff call paging.
5. Capable of being programmed to forward calls destined for a master nurse station to any connected telephone.
6. Telephones connected to the telephone interface shall have the same call tone ring patterns as those generated at the master nurse station.
7. Telephones having a display shall indicate the call type, priority code, and the calling station number of incoming calls.
8. Telephones shall be capable of initiating a service request for a particular patient station, logging calls on the master station's reminder list, and activating door lock mechanisms associated with a call station.
9. Capable of routine setup and configuration changes using the keypads on display telephone and/or the master station.

B. Display Telephones:

1. Digital telephones for use as mini-master nurse-call stations.
2. Digital display shall indicate the call type, priority code, and calling station number of incoming calls.
3. Ring patterns shall be identical to those generated at the master station.
4. Capable of two-way communication with patient and staff stations and the master station, and other telephones interfaced with the system.
5. Capable of placing or answering outside calls when interfaced with the facility telephone system.
6. Capable of "All Call," group call, and staff call paging and of initiating service requests, logging calls to the reminder list, and activating optional door controls.

C. Third-Party Pocket Pager Interface:

1. Equipped with a standalone pocket pager interface.
2. Connects with the facility paging system and transmit alphanumeric messages to the pocket pagers as preprogrammed in the system.

D. Statistical Software:

1. Includes a data statistical software package that stores, sorts, and analyzes activities occurring on the nurse-call system network.
2. Windows based and operated on a PC that is connected to the nurse-call system network.
3. Stores events on the PC's hard disk. Accumulation of these stored events shall make up the database that is used to generate reports and statistics.
4. Events stored by the software shall include date, day of week, time, ward, priority, and room number.
5. Capable of assigning a patient name to bed number.
6. Stored events shall include, but not be limited to, calls placed, call priority, calls cancelled at the nurse station, calls cancelled at the point of origin, regenerated calls, calls answered, calls sent to pager interface, staff presence registration, staff presence cancellation, service request, service cancellation, and system and network error messages.

E. Data Analysis Software:

1. Capable of analyzing the stored information and generating computed analysis.
2. Analysis of the database can be conducted by specifying one, many, or all of the following parameters of the database: date, day of week, time, wards, priority, and room number.
3. Analysis shall include, but not be limited to, total number of calls placed, average call response time (from call placed to call cancellation), total number of presence registrations, average presence time in a room, total number of service requests, average response time (from audio answer to call cancellation), and average ring time (from call placed to audio answer).

F. Statistical Software Package:

1. Capable of displaying multiple calls/events on a PC monitor or on a RS-485 data-bus-driven digital display panel.
2. Calls from patient or staff stations and associated devices shall be displayed by priority. Display shall be customizable as follows:

    a. Choice of color by type of call.
    b. Choice of display size (character size).
    c. Choice of priority levels, type of events, points of origin.
    d. Identification of facility.
    e. Identification of ward.
    f. Identification of patient with specific patient information.

2.5 CONDUCTORS AND CABLES

A. Audio Cables:

1. Conductors: Jacketed, twisted-pair and twisted-multipair, untinned solid copper. Sizes as recommended by system manufacturer, but no smaller than No. 22 AWG.
2. Insulation: Thermoplastic, not less than 1/32 inch thick.
3. Shielding: For speaker/microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.
4. Minimum Shielding Coverage on Conductors: 60 percent.
5. Plenum Cable: Listed and labeled for plenum installation.

B. Data Cable and Hardware: Category 5e UTP and UTP hardware.

C. Power Conductors and Cables: Copper, solid, No. 20 AWG.

D. Grounding Conductors and Cables: Copper, stranded, No. 16 AWG.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wiring Method:

1. Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters.

    a. Install plenum cable in environmental air spaces, including plenum ceilings.
    b. Conceal raceway and cables except in unfinished spaces.

2. Conduit and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems.” Flexible metal conduit shall not be used.

    a. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

B. Install cables without damaging conductors, shield, or jacket.

C. Do not bend cables, while handling or installing, to radii smaller than as recommended by manufacturer.

D. Pull cables without exceeding cable manufacturer's recommended pulling tensions.

1. Pull cables simultaneously if more than one is being installed in same raceway.
2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
3. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage media or raceway.

E. Install exposed raceways and cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours. Secure and support cables by straps, staples, or similar fittings designed and installed so as not to damage cables. Secure cable at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, or fittings.

F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

G. Separation of Wires: Separate speaker/microphone, line-level, speaker-level, and power-wiring runs. Run in separate raceways or, if exposed or in same enclosure, provide 12-inch minimum separation between conductors to speaker/microphones and adjacent parallel power and telephone wiring. Provide separation as recommended by equipment manufacturer for other conductors.

H. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Install terminal cabinets where there are splices, taps, or terminations for eight or more conductors.

I. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks if required.

J. Identification of Conductors and Cables: Comply with requirements in Section 271500 "Communications Horizontal Cabling" for cable administration, cable schedule, and cable and wire identification.

K. Equipment Identification:

1. Comply with requirements in Section 260553 "Identification for Electrical Systems" for equipment labels and signs and labeling installation requirements.
2. Label stations, controls, and indications using approved consistent nomenclature.

3.2 EXISTING SYSTEMS

A. Examine existing systems for proper operation, compatibility with new equipment, and deficiencies. If discrepancies or impairments to successful connection and operation of interconnected equipment are found, report them and do not proceed with installation until directed. Schedule existing systems' examination so there is reasonable time to resolve problems without delaying construction.

3.3 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other signal impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding except at connection to main building ground bus.

C. Grounding Provisions: Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems."

3.4 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.

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.

C. Tests and Inspections:

1. Schedule tests a minimum of seven days in advance.

2. Report: Submit a written record of test results.
3. Operational Test: Perform an operational system test and demonstrate proper operations, adjustment, and sensitivity of each station. Perform tests that include originating station-to-station and "All Call" messages and pages at each nurse-call station. Verify proper routing, volume levels, and freedom from noise and distortion. Test each available message path from each station on the system. Meet the following criteria:

    a. Speaker Output: 90 dB plus or minus 3 dB, 300 to 3000 Hz, reference level threshold of audibility 0 dB at 0.02 mPa of sound pressure.
    b. Gain from patient's bedside station to nurse station, with distortion less than 65 dB (plus or minus 3 dB, 300 to 3000 Hz).
    c. Signal-to-Noise Ratio: Hum and noise level at least 45 dB below full output.

4. Test Procedure:

    a. Frequency Response: Determine frequency response of two transmission paths by transmitting and recording audio tones.
    b. Signal-to-Noise Ratio: Measure the ratio of signal to noise of the complete system at normal gain settings using the following procedure: Disconnect a speaker/microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure the ratio of signal to noise and repeat the test for four speaker microphones.
    c. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 300, 400, 1000, and 3000 Hz into each nurse-call equipment amplifier, and measure the distortion in the amplifier output.

D. Retesting: Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify, by the system test, that the total system meets these Specifications and complies with applicable standards. Report results in writing.

E. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

F. Prepare test and inspection reports.

G. Engage a factory-authorized service representative to train Owner's maintenance personnel and caregiver staff to adjust, operate, and maintain nurse-call equipment.

END OF SECTION 275223

SECTION 28 05 00 - ELECTRONIC SAFETY AND SECURITY GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 28.

B. Applicable provisions of this section apply to all sections of Division 28.

C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See Division 26 for related general and specific requirements.

1.2 CODES AND STANDARDS

A. All equipment and work performed shall comply with all of the current and applicable Codes, Rules, Ordinances, Regulations and Standards (including those not specifically listed in this Specification) as interpreted and enforced by the authorities having jurisdiction including:
1. Americans with Disabilities Act (ADA)
2. Authorities Having Jurisdiction (AHJ) - Local
3. American National Standards Institute (ANSI)
4. American Society of Testing and Materials (ASTM) Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732
5. Building Industry Consulting Services International (BICSI)
6. Code of Federal Regulations - Title 47
7. Electronics Industries Association (EIA) Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series
8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
9. Federal Information Processing Standards (FIPS) Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176
10. The Insulated Cable Engineers Association (ICEA) Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685
11. International Electro-technical Commission (IEC)
12. Institute of Electrical and Electronic Engineers (IEEE) Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series
13. International Organization for Standardization (ISO) (ISO/IEC) Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1
14. International Telecommunication Union (ITU-T) Telecommunications Standardization
15. National Electrical Code (NEC) National Electrical Code - NFPA 70
16. National Electrical Contractor's Association (NECA) Standards of Installation
17. National Electrical Manufacturers Association (NEMA) Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66
18. National Electrical Safety Code (NESC)
19. National Fire Protection Association (NFPA) - National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101
20. Society of Cable Telecommunications Engineers (SCTE)
21. Local Accessibility Standards

22. Telecommunications Industries Association (TIA) (ANSI/TIA/EIA) Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95
23. Uniform Building Code (UBC)
24. Underwriters Laboratories, Inc. (U.L.) - 497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977

B. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

C. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

D. Obtain all permits required.

1.3 SUMMARY

A. Provide complete and working ESS Systems including equipment, conduit, wiring, material, labor and training as described in this Specification and the Drawings. The ESS Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All ESS Systems plans and specifications are to be returned to the Architect following completion of bid.

1.4 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.5 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact

location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.

1. Make final connections to all ESS equipment indicated on the drawings, except as noted.

F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.

G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.6 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.7 GUARANTEE

A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.8 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.9 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.10 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 28 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit complete design and

performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

1.11 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work:
   1. Obtained from utility maps and other substantially reliable sources.
   2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.

B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.12 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

1.13 ABBREVIATIONS AND DEFINITIONS

Abbreviations:

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CMP	Communications Media Plenum
CMR	Communications Media Riser
dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
ESS	Electronic Safety and Security
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Hz	Hertz
IDF	Intermediate Distribution Frame
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MDF	Main Distribution Frame
MHz	Megahertz
NEXT	Near-End Cross Talk
nm	Nano-meter

OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
TC	Telecommunications Closet *(Now referred to as TR)*
TR	Telecommunications Room *(A.K.A. TC - Telecommunication Closet)*
UTP	Unshielded Twisted Pair Wire

Definitions:

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the ESS Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the ESS Systems operational or for system communications.

Electronic Safety and Security Systems - One or more of the following and associated equipment: Fire Detection/Alarm Systems, Intrusion Detection/Alarm Systems, Access Control Systems, Video Surveillance Systems,

1.14 QUALITY ASSURANCE

A. Equipment Standards:
   1. System and all components shall be brand new stock from manufacturer.
   2. All electronics shall be 100% solid state.
   3. System and all components shall bear a UL Label.

B. Contractor Qualifications:
   At the time of Proposal, the Contractor shall:
   1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
   2. Hold all legally required State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
   3. Hold all legally required state registrations to meet local requirements for submittal drawings.
   4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
   5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.15 SUBMITTALS

A. Provide SUBMITTALS according to Division 1 and the following.

B. Requirements:
   1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
   2. Submit proof that all system components and cables are U.L. Listed.
   3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
   4. Product technical information sheets for each principal components in the proposed system, including cable, wire, terminal marking, and wire marking material.
   5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
   6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted, but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.16 EXAMINATION OF SITE

A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and not included in his proposal.

B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.17 DATA ACCURACY

A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.18 SECURITY

A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.

B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.19 UTILITIES

A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.20 PERMITS

A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.21 NOTIFICATION

A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar day's notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

1.22 INTERFERENCES WITH THE OWNER

A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

1.23 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and underslab cables installed, dimensioning exact location and elevation of such installations.

B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2012 / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
   1. 3 sets of electronic AutoCAD (2012 dwg) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
   2. One reproducible Dayrex mylar film positive of each contract as-built drawing.

3. Three sets of blue or black-line prints of each contract as-built drawing.

C. As-Built Drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
2. Remove Engineer's Seal, name, address, and logo from drawings.
3. Mark documents AS-BUILT DRAWINGS.
4. Clearly indicate: DOCUMENT PRODUCED BY:
5. Indicate all changes to construction during construction. Indicate actual routing of all conduit and cables, etc that were deviated from construction drawings.
6. Indicate exact location of all underground ESS raceways, and elevations.
7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
9. Exact location of all ESS equipment in building. Label panel schedules to indicate actual location.
10. Exact location of all ESS equipment in and outside of the building.
11. Location, size and routing of all ESS cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
13. Cloud all changes.

1.24 OPERATING TESTS

A. After all ESS systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.25 WARRANTY

A. All equipment shall be covered for the full manufacturer's warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.

B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.26 BUILDING CONSTRUCTION

A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.27 TEMPORARY FACILITIES

A. General: Refer to Division 01 for general requirements on temporary facilities.

B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.

C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.28 EXTRA MATERIALS

A. Keys: Provide three (3) sets of all keys for system cabinets.

PART 2 - PRODUCTS

2.1 WORK INCLUDED:

A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.

B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.

C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be assumed to ensure a complete, functional system.

D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals and As-Built drawings.

E. If appropriate, interfaces with the Owner's Data Network or Telecommunications System shall be coordinated with the Owner and Architect.

F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.

G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a junction box, to the system devices. Provide as required and as specified in Division 26.

H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.

I. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.

J. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.

K. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation if applicable, the more stringent shall apply.

L. Where new equipment is replacing old equipment, the Contractor is responsible for removing and disposing of the old equipment and doing whatever repair work is necessary as specified by the Owner / Architect.

M. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.

N. The installation shall be performed in a professional manner.

O. On a daily basis, clean up and deposit in appropriate containers all debris from work performed under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.

P. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.

Q. All work shall conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.

R. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

3.2 COORDINATION WITH OWNER / ARCHITECT

A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of job progress.

3.3 CUTTING, PAINTING, AND PATCHING

A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.

B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

3.4 WIRE AND CABLE

A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.

B. All wires in exposed areas shall run through conduit as specified in Division 26.

C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.

D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.

E. Run wires continuously from termination to termination without splices.

F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at not rime shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.

G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2” or larger sized conduits.

H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.

I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building

structure (do not support from pipes or conduits). ESS cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.

J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

3.5 IDENTIFICATION AND TAGGING

A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 *or equal*). Handwritten tags are not acceptable.

B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all ESS Systems wiring.

C. All panels shall be provided with permanently attached engraved lamacoid labels with identifying names and functions. All terminal points shall be appropriately labeled. Labels shall be consistent in form, color, and typeface throughout the system, and all must contain the name of the system or subsystem as part of the label textual information. Design, color, font and layout shall be coordinated with, and approved by, the Owner.

D. Identification of Equipment:
1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions.
2. A black-white-black 3 layer laminated plastic engraved identifying nameplate shall be permanently secured to each wireway, terminal cabinet, and ESS cabinet or rack.
   a. Identifying nameplates shall have 1/2-inch high, engraved letters.
3. Permanent, waterproof, black markers shall be used to identify each ESS grid junction box, clearly indicating the type of system available at that junction box.
4. Pull Boxes: Field work each with a nameplate showing identity, and identifying equipment connected to it. Nameplates shall also indicate where pull box is fed from.

E. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.

F. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of ESS facilities. Provide text of sufficient size to convey adequate information at each location, mount permanently in an appropriate and effective location. Comply with industry standards for color and design.

G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways. Identify with drop/circuit number.

H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red or orange with suitable warning legend describing buried ESS lines. All underground conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground conduits.

3.6 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 01 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.7 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the ESS systems.
   1. Provide the training during regular working day.
   2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.

B. Time to be allocated for instructions.
   1. Minimum of 12 hours dedicated instructor time
   2. 4 hours on each of 3 days
   3. Additional instruction time for specific systems as specified in other Sections.

C. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
   1. One copy to the Owner
   2. One copy to the Architect / Engineer

D. The Owner shall provide a list of personnel to receive instructions and shall coordinate their attendance at the agreed upon times.

E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.8 OPENINGS

A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.9 HOUSEKEEPING PADS

A. Provide concrete equipment housekeeping pads under outdoor mounted ESS equipment.

B. Concrete and reinforcing steel shall be as specified in Division 03, or as indicated or noted.

C. Concrete pads:
1. 6-inches thick minimum indoors; 8-inches thick minimum outdoors, or as indicated on the drawings or in other sections of the specifications.
2. Chamfer strips at edges and corner of forms.
3. Smooth steel trowel finish.
4. Extend 3-inches minimum indoors beyond perimeter of equipment unless otherwise shown.
5. 6-inch x 6-inch #8 wire reinforcement mesh.

3.10 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.11 VANDAL RESISTANT DEVICES

A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.

B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.12 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.13 EQUIPMENT BACKBOARDS

A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
   1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each location shown.
   2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each ESS location.

3.14 SITE MANAGEMENT RESPONSIBILITY

A. The Contractor shall provide an on-site Project Manager as defined in SUPERVISION OF WORK portion of this Section.

3.15 START-UP RESPONSIBILITY

A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all ESS Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect's judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer's factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.

B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.

C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should include:
   1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
   2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and operational.

3.16 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.

B. All materials shall be neat, clean and unmarred, and parts securely attached.

C. All extra material as specified shall be delivered and stored at the premises as directed.

D. Test reports of each system and each system's components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

3.17 SYSTEM ACCEPTANCE REQUIREMENTS

A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.

B. The Contractor shall deliver three (3) composite "System Operations and Maintenance" manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:

1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that cam in the original shipping container for that piece of equipment. Include all warranty cards.

C. Testing:
1. The Contractor shall perform all tests required by Division 28 and those submitted as part of this Section.
2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.

D. As-Built Drawings:
1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.

E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System’s performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
1. System Operations and Maintenance Manuals
2. System Test Reports
3. As-Built Drawings

3.18 NOTICE OF COMPLETION

A. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION

SECTION 28 05 10 - CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide a manufacturer’s qualified personnel to observe:
   1. Field conditions.
   2. Condition of installation.
   3. Quality of workmanship.

4. Start-up of equipment.
5. Testing and adjusting of equipment.

B. Manufacturer's qualified personnel shall make written report of observations and recommendations to Architect/Engineer.

1.7 MOCK UPS

A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals, and finishes.

B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.

C. Acceptable mock-ups in place shall be retained in the completed work where possible.

D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
1. Rough-in
2. Finish with all appurtenances in place
3. Demonstrations

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's qualified personnel at no additional cost to Owner.

3.2 MOCK-UPS

A. Mock up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION 280510

SECTION 28 10 00 - ELECTRONIC ACCESS CONTROL SYSTEM

PART 1 – GENERAL

1.1 WORK INCLUDED

A. The contractor shall furnish and install a complete microprocessor based access control system as specified herein. The system shall include, but not be limited to, all control equipment, power supplies, power circuits, signal initiating and signaling devices, door hardware, conduit, wire, fittings, labor and all other accessories required to provide a fully functioning system.

1.2 CODES AND STANDARDS

The system shall comply with the applicable Codes and Standards as follows:

A. National Fire Protection Association Standards:
   1. NFPA 70 National Electric Code
   2. NFPA 72 National Fire Alarm Code
   3. NFPA 101 Life Safety Code

B. Local & State Building Codes

C. Requirements of Local Authorities having Jurisdiction

D. Underwriters Laboratory Requirements and Listings for use in Security Alarm Systems.

E. Requirements of American Disabilities Act (Public law 101-336).

F. State Fire Marshall.

1.3 RELATED WORK

A. Division 08- Door Hardware

B. Section 28 20 00 – Video Surveillance

1.4 DEFINITIONS

A. ACS – Access Control System

B. CSA – Client Software Application

C. DGM – Dynamic Graphical Maps

D. ALPR – License Plate Recognition

E. SDK – Software Development Kit

F. SMA – Software Maintenance Agreement

G. SSM – Server Software Module

H. UI – User Interface

I. USP – Unified Security Platform

J. USW – Unified Web Client

K. VMS – Video Management System

L. DVS – Digital Video Server

1.5 QUALITY ASSURANCE

A. Contractor Qualifications:
1. The installing contractor shall be the authorized representative of the access control system manufacturer to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the security alarm manufacturer's product for at least two years.
2. The installing contractor shall be licensed by the State as a security services contractor to design, sell, install, and service security alarm systems.
3. The installing contractor shall provide 24 hours, 365 days per year emergency service with factory trained service technicians.
4. The installing contractor shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least ten (10) years.

B. The system programmer shall have attended manufacturer training and obtained certification in provided system.

C. Optionally, the system programmer shall have attended manufacturer training and obtained certification in provided system.

D. All Contractors shall submit to the Owner prior to starting any work the factory training certificates for all personnel that will be working on the access control system. No person is allowed to work on the system without proper manufacturer's certification.

1.6 SUBMITTALS

A. The installing contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:
1. Control panel wiring and interconnection schematics.
2. Complete point to point wiring diagrams.
3. Riser diagrams.
4. Complete floor plan drawings locating all system devices.
5. Factory data sheets on each piece of equipment proposed.
6. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
7. Complete system bill of material.
8. Line by line specification review stating compliance or deviation.

B. All submittal data will be in bound form with Contractor's name, supplier's name, project name, and state security license number adequately identified.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Head-End/Software
   1. Stratus
   2. Kastle
   3. Salto

B. Controllers
1. HID

C. Card Readers
   1. HID – Public Doors
   2. Schlage – Residential Doors

D. Guest Entry System
   1. Butterfly MX
   2. Mircom

E. Wiring
   1. Belden
   2. Approved Equal

2.2 PERFORMANCE REQUIREMENTS

A. Controllers:
   1. System Controller:
      a. Up to 64-Doors
      b. 12-24VDC
      c. Minimum quantity of one (1) RS-485 output
   2. Door Controller
      a. Minimum quantity of two (2) reader outputs
      b. 12-24VDC
      c. RS-485 communication

B. Card Readers
   1. MutliClass reader
   2. 50/75mA @ 12VDC
   3. Wiegand interface
   4. Wall mounted: RP40
   5. Mullion mounted: RP10
   6. Unit Lock Access: Control Z-Wave System
      a. Must be able to integrate within Genetec.
   7. Cards: 125KHz prox technology/KeyFobs

C. Wiring

1. Plenum rated
2. Minimum of 18 AWG

PART 3 - EXECUTION

3.1 GENERAL

A. The contractor shall have furnished and installed a complete microprocessor based access control system as specified herein. The system shall include, but not be limited to, all control equipment, power supplies, power circuits, signal initiating and signaling devices, door hardware, conduit, wire, fittings, labor and all other accessories required to provide a

3.2 HARDWARE INSTALLATION

A. General
1. Provide mock-up of a typical entry door, complete with conduit, outlet boxes, cables and access control devices prior to installation.
2. All 120V Power shall be furnished as specified in Division 26. Coordinate with Division 26.
3. All security conduit as required for a complete installation of this system shall be provided as specified in Division 26.
4. Coordination with the Division 26 is the responsibility of the Security Contractor to ensure all conduit is in place for a complete installation.
5. All systems shall be connected to a dedicated circuit and on an emergency power source if available.
6. All door hardware to be coordinated with Division 08, reference Division 08 for hardware requirements.

B. Wiring/Conduit
1. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
2. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so approved by the local authority having jurisdiction.
3. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.
4. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
5. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
6. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
7. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors trans versing the respective box as well as the number of terminations required.
8. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring tight up against structure for protection. Cable shall be bundled on a maximum of 2'-6" and secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated cable ties.
9. Contractor is required to provide all mapping and software configuration required to operate system as per manufacturer’s recommendations.

10. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated j-hook style cable support system for the entire run of each cable. Including, but not limited to service loops.
11. The cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5’ of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5’ of the finished ceiling and mount the support hook to the treaded rod.
12. Power wiring may all be run from central location for door hardware.

C. System
1. Furnish and install one (1) card reader for each location shown on drawings.
2. Provide and install a centralized architecture, with each access panel being installed on the wall in the each of the (2) new Building IDF closets. Running each half of the building to the closets on the plan north and plan south. Centralized power supply for locking hardware is preferred. Provide one CloudLink device per closet where an access panel is being installed, for network tie-in.
3. Furnish and install one (1) unit lock, for each unit location shown on drawings.
4. Furnish and install quantity of Multi-Device Interface Panel necessary to add all door position switches into system.
5. Provide an additional four (4) hours per site of programming, coordinate final programming with Owner’s personnel.

3.3 TESTING

A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner, Engineer, Electrical Contractor and performed by the equipment supplier. Final test report shall be received and acknowledged by the Owner prior to substantial completion.

B. Provide instruction as to proper use and operation of system, for the Owner's designated personnel.

3.4 DEPLOYMENT SERVICES AND SYSTEM COMMISSIONING

A. General Requirements
1. The contractor shall engage the services of the USP vendor to assist in the management of the deployment of the USP at the end-user site on the project.
2. The USP vendor services shall include Deployment Management and System Configuration and Commissioning.

B. Deployment Management Service
1. The Deployment Management service from the vendor shall include a Project Manager acting as the single point of contact for all communications between the contractor and the vendor organization and who will be responsible for:
    a. Conducting a Risk Assessment of the impact of potential risk factors on the operation of the vendor's USP.
    b. Providing a project plan for the deployment of the vendor's USP.
    c. Managing the development and deployment of the custom solution components that will be integrated into the vendor's USP (if applicable).
    d. Providing a scope of work detailing the services to be provided by the vendor to assist in the deployment of the vendor’s USP.
    e. Coordinating and scheduling the vendor field services with the contractor to assist with the deployment of the vendor’s USP.
    f. Providing regular project status updates to the contractor regarding the development of custom solutions (if applicable) and the deployment of the vendor’s USP.

C. System Configuration and Commissioning Service
   1. The System Configuration and Commissioning service from the vendor shall include a Field Engineer who will be responsible for:
      a. Assisting the contractor's or/subcontractor's onsite/remote technicians with the configuration and commissioning of the vendor's USP at the client site.
      b. Conducting a test of the USP following the deployment of the system using real-world operator scenarios to ensure optimal system performance.
      c. Providing the contractor with a Service Report detailing the tasks completed during the deployment of the USP at the client site, as well as any recommendations for improving the performance of the USP that must be implemented by the contractor.
      d. Providing a knowledge transfer of the vendor's USP to the contractor following the deployment of the USP at the client site.

3.5 WARRANTY

A. Contractor shall provide minimum of one (1) year warranty of workmanship and product. Must support (24) hour turn time to fix and/or replace any system issues or hardware

B. The product shall perform in all material respects in accordance with the accompanying user manual, and the media on which the Software Product resides will be free from defects in materials and workmanship under normal use. Software defects are covered through Service Releases and Cumulative Updates which are available for a period of 1 year from the date of substantial completion

END OF SECTION 281000

SECTION 28 20 00 - VIDEO SURVEILLANCE

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish and install IP closed-circuit television system including cameras, mounts, licensing, NVR.

B. The contractor shall coordinate with other system vendors, where appropriate, to facilitate equipment installation, scheduling, protection of equipment and access to the project site in order to provide the Owner a substantially complete project in a timely manner.

C. Contractor is responsible for coordinating all electrical work required on this project for connection of servers, cameras, conduit, and power supplies. Contractor shall provide a complete solution to the owner and be responsible for the complete installation of the video security camera system. Power requirements for the NVR and in-wall conduits shall be provided by Division 26. Any additional power requirements for power supplies and additional pathway conduits/sleeves are to be provided by the system installing contractor's licensed electrician or the project's electrical contractor.

D. Contractor will be required to meet with Owner's security representative before any cabling is to be installed to walk the site and coordinate proposed camera locations and cable routing.

E. The NVR shall be provided by the Contractor. Data cabling for IP/Poe cameras shall be provided as specified in the Structured Cabling System, by the structured cabling contractor.

F. Contractor shall provide a complete installation of camera including testing of all cameras. Testing and camera aiming must be conducted in conjunction with the Owner's Security personnel prior to installation.

G. Locate equipment to accommodate millwork, fixtures, marker boards and other room equipment at no additional cost to the Owner.

1.2 RELATED SECTIONS

A. Division 26 and Division 27

1.3 DEFINITIONS

A. ACS – Access Control System

B. CSA – Client Software Application

C. DGM – Dynamic Graphical Maps

D. DVS – Digital Video Server

E. LPR – License Plate Recognition

F. NVR – Network Video Recorder

G. SDK – Software Development Kit

H. SMA – Software Maintenance Agreement

I. SSM – Server Software Module

J. UI – User Interface

K. Video Platform – Unified Security Platform

L. USW – Unified Web Client

M. VMS – Video Management System

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   1. The contractor shall be licensed and shall meet all applicable regulations. The contractor shall be a firm normally employed in the security industry.
   2. The contractor shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein. Each contractor shall furnish with their submittal a letter from the manufacturer indicating they are a dealer in good standing.
   3. The contractor 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.
   4. 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 video surveillance distribution systems and have personnel who are adequately trained in the use of such tools and equipment.
   5. A resume of qualifications shall be submitted with the Contractor's proposal indicating the following:
      a. A list of five recently completed projects using the product proposed of similar type and size with contact names and telephone numbers for each.
      b. A list of test equipment proposed for use in verifying the installed integrity of metallic cable systems on this project.
      c. A technical resume of experience for the contractor's Project Manager and on-site installation supervisor who shall be assigned to this project.
      d. A list of technical product training attended by the contractor's personnel that shall install the video surveillance system shall be submitted.
      e. Any subcontractor who shall assist the video surveillance contractor in commissioning / programming of this work shall have the same training and certification as the video surveillance contractor.

B. It is acceptable for a non-certified contractor to furnish and install security cameras. Final licensing, and commissioning / programming shall be performed by VMS manufacturer certified contractor.

C. Contractor must be a current integrator of solution in the area, have a permanent office located within 75 miles of the project, and be able to include information on current support staff to be able to service this client.

D. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

E. Contractor shall schedule a pre-construction meeting with Owner / Engineer to review specific project requirements.

F. The system programmer shall have attended manufacturer training and obtained certification in chosen system partner

G. The system programmer shall be a certified programmer in the chosen video platform

H. The system programmer shall submit proof of certifications.

1.5 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Local Building Code
2. Local Electrical Code
3. NEC National Electrical Code

B. Other references:
1. TIA/EIA-568-A - Commercial Building Telecommunications Wiring Standard
2. EIA/TIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
3. TIA/EIA-606 - The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
4. TIA/EIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
5. TIA/EIA TSB 67 - Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
6. ISO/IEC 11801 - Generic Cabling Standard
7. EN 50173 - Generic Cabling Standards for Customer Premises

C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes, regulations, and manufacturer installation requirements, then the requirements of these specifications and the drawings shall govern. However, nothing in the drawings or specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

1.6 SUBMITTALS

A. Contractor shall meet with Owner’s Security representative prior to submission of formal/final shop drawings to Engineer to allow the Owner and Engineer to review a preliminary draft copy of the submittal to verify compliance with the specifications and any detailed requirements of the project. The contractor shall then submit the final and formal submittal to Engineer for review. After the draft submittal has been reviewed by the Owner / Engineer, and formal shop drawings have been reviewed by Engineer and returned to the Contractor, the required pre-construction meeting shall take place with Owner / Engineer.

B. The video surveillance system installer shall furnish all CCTV system submittals in a single consolidated submittal.

C. Shop Drawings: Submit the following items, for Owner review and approval:
1. Samples: Complete manufacturer’s product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the Project.

2. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Engineer
3. Product Literature: Complete manufacturer's product literature for all electronics, cable, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Engineer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included.
4. Testing: Proposed Contractor test result forms, a list of instrumentation to be used for systems testing.
5. A complete point-to-point floor plan diagram indicating camera locations and all required cabling to connect systems.

D. Project Completion: As a condition for project acceptance, the Contractor shall submit the following for review and approval:
1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
2. Operating and Maintenance Manuals for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description.
3. All training sessions with Owner's staff and training media shall be complete.
4. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. The as-built drawings shall be prepared using AutoCAD V. 2013 or later. Provide the Owner with electronic versions of the as-builts on CDs.

PART 2 – PRODUCTS

2.1 GENERAL

A. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

B. Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the specifications. All approved equivalent products shall be published by addendum ten days prior to proposal for Engineer review.

C. All equipment and materials used shall be standard components, regularly manufactured, regularly utilized in the manufacturer's system.

D. All systems and components shall have been thoroughly tested and proven in actual use.

E. All systems and components shall be provided with the availability of a toll free 24-hour technical support phone number from the manufacturer. The phone number shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge.

F. All systems and components shall be provided with an explicit manufacturer warranty.

2.2 DATA CLOSET (MDF/IDF) TERMINATION HARDWARE

A. Security contractor is responsible to coordinate with data/voice cabling contractor on acquiring network connections. Contractor shall coordinate with Owner's technology department on acquiring any network configuration information such as IP numbers that will be required to connect NVR to Owner's network.

B. Structured Cabling Contractor is responsible to provide network cabling connection, either fiber or category 6, to Owner provided network equipment. This connection allows NVR/Cameras to be connected to Owner's local area network.

2.3 CABLE AND INSTALLATION

A. The data cabling to each camera location on this project shall be provided by Structured Cabling Contractor installing new infrastructure on site.

B. Provide all penetrations and all conduits as necessary for installation of CCTV installation.

C. All exterior penetrations require necessary weatherproofing to avoid moisture penetration.

D. All outdoor cable runs underground shall be rated for underground use.

E. Provide all power circuits required for the NVR and camera power supplies.

G. Contractor shall not run any power cabling for any security equipment on rack tray system due to EMI considerations. Contractor shall provide individual cabling support for all low voltage power cabling.

H. All cabling for entire project shall be installed at 5'-0" intervals in dedicated support system using supports such as j-hooks or saddle support systems. Cable supports shall be securely attached directly to building structure. Do not attach cabling or supports to ductwork, piping, grid hangers, conduit, or equipment.

2.4 CAMERAS

A. ACCEPTABLE MANUFACTURERS –
1. Bosch
2. Sony
3. Axis
4. Panasonic
5. Pelco
6. Samsung
7. Vivotek
8. Arecont

B. Interior Dome Cameras:
1. 2 MP minimum
4. Varifocal Lens
5. SD Card Slot
6. True Day/Night with IR Cut Filter
7. Edge Analytics
8. Capable of Alarm Triggering
9. PoE powered
10. H.264 Compression

C. Outdoor Dome Cameras:

1. 2 MP Minimum
2. IP68
3. IK10 Vandal Resistant
4. Varifocal Lens
5. SD Card Slot
6. True Day/Night with IR Cut Filter
7. Edge Analytics
8. Capable of Alarm Triggering
9. PoE powered
10. H.264 Compression

D. Field of View Determination by the contractor as necessary for fixed camera locations shall be performed at no additional cost to provide the view desired by the owner. Contractor shall coordinate all final camera views and locations with owner for final approval.

E. Ceiling mounted cameras shall be installed with the weight of the camera being supported by the building structure. At no point should the weight of any camera be supported by the ceiling tile.

F. All cameras installed shall be focused at nighttime in black and white/low resolution mode to insure the best possible view.

2.5 VIDEO SERVER AND EQUIPMENT

A. IP Camera Server
1. 16 Terabyte Storage Capacity
2. RAID 5 Configuration
3. 110V NEMA 5-15P
4. 8 Frames per Second
5. 50% motion event recording

B. Licensing: Provide the Owner with all licenses as required for installation.

2.6 VMS GENERAL REQUIREMENTS

A. Manufacturer:
1. Avigilon
2. Genetec
3. Milestone

B. The VMS shall be based on a true open architecture that shall allow the use of non-proprietary workstation and server hardware, non-proprietary network infrastructure and non-proprietary storage.

C. The NVR shall be multicast enabled.

2.7 ARCHIVING

A. Coordinate programming of IP address of Owner provided wide area archiver.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Cable Support:
1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable j-hook style support system for the entire run of each cable. Including, but not limited to service loops.
2. The cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5’ of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5’ of the finished ceiling and mount the support hook to the treaded rod.
3. Cable support shall be installed at a maximum of 5’ on center.
4. All cable installed shall be attached to the hook support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each cable support to keep wires neatly bundled throughout the entire run. Tie wraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.
5. Absolutely no cable, not installed in conduit, will be allowed to be attached directly to the building’s steel or supported in any other method than that stated above.
6. It is the responsibility of the installing contractor to coordinate with all other trades on the project to ensure that the pathway of this system does not interfere with the installation of the other trades and to prevent the installed product of other trades from putting strain on the installed wiring.
7. Do not route cable through webbing of structural steel.

B. Conduit / Raceway:

1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
5. All conduit ends shall have a protective bushing to prevent cable damage. Bushings must be installed prior to installing cable. Cutting bushing to install around installed cables will not be accepted.

C. Fire Wall Penetrations: The Contractor shall avoid penetration of fire rated walls and floors wherever possible. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.

D. Wall Penetrations: Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.

E. Install new roof mounted conduits on portable pipe supports – (low profile type), as manufactured by Portable Pipe Hangers or Advanced Support Products. Provide roof protection pads under each support. Coordinate location and routing with design engineer prior to rough-in or installation of system.

F. Do not install wall mounted cameras into metal fascia. Ensure they are mounted into brick, and sealed top and sides (not bottom)

3.2 EQUIPMENT RACK CONFIGURATION

A. Cable Placement: Cable installation in the wiring closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

B. Cable shall be routed as closely as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the wiring closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.

C. All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels.

3.3 WIRING INSTALLATION

A. General:
   1. All network cabling shall be provided and installed by the network cabling contractor. Cabling between wiring closet and camera locations shall be made as individual home runs. No intermediate splices may be installed or utilized between the wiring closet and the camera location.
   2. All cable must be handled with care during installation so as not to change performance specifications.
   3. Coordinate jack color with structured cabling specification.

B. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner’s efficient use of their full capacity.

3.4 ADDITIONAL REQUIREMENTS

A. Confirm rack hardware mounting locations with Owner prior to installation.

B. Coordinate with network cabling contractor to ensure installation of cable service loops to all camera locations and future camera locations.

C. Provide final aiming, focus, and other camera configuration adjustments as directed by Owner.

3.5 DOCUMENTATION

A. Labels: The Contractor shall label all outlets using permanent machine engraved labels approved by the Owner. Label patch panels in the wiring closet to match those on corresponding camera locations. The font shall be at least one-eighth inch (1/8”) in height, block. All labels shall correspond to as-built and to final test reports.

B. Contractor shall ensure complete typed labeling of all cameras with numbers that correspond to locations on video server. Labeling system shall correspond to the Owner’s labeling system.

Verify with Owner. Provide tags (black letters on white labels, plastic coated) on all cables and outlets.

C. All cables shall be labeled at both ends with a machine label and all terminations shall be stenciled with a typed label for quick circuit identification. Labeling shall conform to TIA/EIA standard 606 and include interconnect cable identification numbers.

D. A floor plan, clearly labeled with all numbered camera locations, shall be included in the as-built plans.

3.6 CABLE TESTING - BY MANUFACTURER'S REQUIREMENTS

A. Notification: The Owner/Engineer/Consultant shall be notified one week prior to any testing so that the testing may be witnessed.

B. Final Acceptance: Before requesting a final acceptance, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and time table for all copper and fiber optic cabling.

C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation shall be evaluated in the context of each of these factors.

D. Errors: When errors are found, the source of each error shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Retest results must be entered on the test results form. All corrections shall be made prior to final acceptance test.

3.7 INSPECTION

A. Conformance to the installation practices covered above is to be verified when completed. In some cases, the Owner/Engineer may observe before acceptance.

3.8 WARRANTY

A. The product shall perform in all material respects in accordance with the accompanying user manual, and the media on which the Software Product resides will be free from defects in materials and workmanship under normal use. Software defects are covered through Service Releases and Cumulative Updates which are available for a period of 1 year from the date of the software purchase.

3.9 DEPLOYMENT SERVICES AND SYSTEM COMMISSIONING

A. General Requirements
   1. The contractor shall engage the services of the Video Platform vendor to assist in the management of the deployment of the Video Platform at the end-user site on the project.
   2. The Video Platform vendor services shall include Deployment Management and System

Configuration and Commissioning.

3. Provide 4 hours of system programming per site.

B. Deployment Management Service

1. The Deployment Management service from the vendor shall include a Project Manager acting as the single point of contact for all communications between the contractor and the vendor organization and who will be responsible for:

a. Conducting a Risk Assessment of the impact of potential risk factors on the operation of the vendor's Video Platform.

b. Providing a project plan for the deployment of the vendor's Video Platform.

c. Managing the development and deployment of the custom solution components that will be integrated into the vendor's Video Platform (if applicable).

d. Providing a scope of work detailing the services to be provided by the vendor to assist in the deployment of the vendor's Video Platform.

e. Coordinating and scheduling the vendor field services with the contractor to assist with the deployment of the vendor's Video Platform.

f. Providing regular project status updates to the contractor regarding the development of custom solutions (if applicable) and the deployment of the vendor's Video Platform.

C. System Configuration and Commissioning Service

1. The System Configuration and Commissioning service from the vendor shall include a Field Engineer who will be responsible for:

a. Assisting the contractor's or/subcontractor's onsite/remote technicians with the configuration and commissioning of the vendor's Video Platform at the client site.

b. Conducting a test of the Video Platform following the deployment of the system using real-world operator scenarios to ensure optimal system performance.

c. Providing the contractor with a Service Report detailing the tasks completed during the deployment of the Video Platform at the client site, as well as any recommendations for improving the performance of the Video Platform that must be implemented by the contractor.

d. Providing a knowledge transfer of the vendor's Video Platform to the contractor following the deployment of the Video Platform at the client site.

3.10 MANUFACTURER END USER OPERATOR TRAINING

A. The contractor shall engage the services of the Video Platform vendor to assist in the end user training of the Video Platform at the end-user site for 4 hours of training.

END OF SECTION 282000

SECTION 283100 - LIFE SAFETY SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 260000.

B. This specification section shall be considered a design-build specification. The Fire Alarm Contractor shall be considered the Engineer of Record for this scope and shall provide signed and sealed shop drawings at the request of the LAHJ.

1.2 CODES AND STANDARDS

A. All equipment shall be U.L. listed for its intended use.

B. All raceways and wiring shall be installed in compliance with NFPA Standard 70 (National Electrical Code - 2014 Edition).

C. NFPA Standards 71 and 72.

D. NFPA 101, Life Safety Code.

E. American National Standard A117/1.

F. Standard Building Code.

G. Underwriters Laboratories Fire Resistance Directory.

H. Applicable local codes and regulations.

1.3 PERMITS AND APPROVALS

A. Prior to commencement and after completion of work, notify authorities having jurisdiction.

B. Submit letter of approval for installation and a Certificate of Compliance (NFPA 72-2-2) before requesting acceptance of system.

1.4 SUBMITTALS

A. Section Cross Reference: Refer to Division 01, Submittals, for general requirements.

B. Provide manufacturer's roughing-in diagrams, written product specifications and instructions for installation:

1. Include copies of manufacturer's published product warranties.
2. Include point-to-point wiring diagrams.
3. Provide data sheets on each item of equipment.

4. Provide list of all types of equipment and components provided.
5. Provide floor plans indicating locations of all required components including specific ratings of devices (candela, etc).
6. Provide description of operation of system to include any and all exceptions, variances, or substitutions listed at the time of bid. Any such exceptions, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval.
7. Provide calculations to support size of standby batteries submitted.
8. Complete sequence of operations of all functions of the system.
9. A list of every system address provided for purposes of alarm initiation, status monitoring, supervised signaling, and auxiliary controls.
10. Complete system wiring diagrams for all components and interfaces to equipment supplied by others.
11. A listing of the manufacturer's representatives responsible for installation coordination and service along with their NICET Certification and Level Numbers.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. The work covered by this Section of the Specifications shall include all labor, equipment, materials and services to furnish and install a complete Fire Alarm System. The system equipment as covered by these specifications, shall be wired, connected, and left in first class operating condition. The system shall use supervised multiplex data communications circuits, closed loop initiation circuits, individual zone supervision, and individual audio and visual signal circuit supervision. The system shall consist of, but not be limited to, the following:

1. Fire Alarm Control Panels
2. Annunciator Panel.
3. Manual Fire Alarm Stations.
4. Area Smoke Detectors.
5. Duct Mounted Smoke Detectors (Installed by Division 23).
6. Remote Annunciator Panel
7. Speaker/Strobe Alarm Signals.
8. Central station alarm and trouble connection control.
9. Signals to the Building Automation System.
10. Battery Backup.
11. Speakers
12. Voice Evacuation System
13. Beam Smoke Detectors

B. The design/build contractor shall be responsible for coordination with all other trades regarding conduit, wire, connections and all equipment necessary to monitor and annunciate all of the equipment they provide.

2.2 GENERAL SYSTEM OPERATION

A. The fire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the Fire Alarm Control Panel. Any opens, grounds or disarrangement of system wiring and shorts across alarm signaling wiring shall automatically:

1. Sound an audible signal at the Fire Alarm Control Panel and Annunciator Panel. The audible signal shall be capable of being silenced during the trouble condition.
2. Light the general trouble LED (yellow) at the Fire Alarm Control Panel. The general trouble LED shall remain lit until the trouble condition is repaired.

B. The Fire Alarm Control Panel shall be provided with the ability to provide bypass of automatic alarm functions, such as central station alarm notification and signals to the Building Automation System during fire alarm system tests.

C. The alarm activation of any system smoke detector shall initiate an alarm confirmation operation whereby the system shall verify the status of the detector and wait for a second alarm. If a second alarm is reported from the same smoke detector location within one (1) minute, then the system shall process the alarm per the operations listed above. If no second alarm occurs within one minute, then the system shall resume normal operations. The system printer and History Logging of the Fire Control Panels shall record the first alarm, the second alarm, and the return to normal operations with the corresponding time of each occurrence. This alarm confirmation operation shall be only for smoke detector alarms. All other sources of alarm shall be processed immediately.

D. The system operation shall be such that the alarm operation of any alarm initiating device shall not prevent the subsequent alarm operation of any other initiating device due to wiring or power limitations. All initiating devices shall be capable of being in alarm simultaneously.

E. The act of turning any sprinkler valve shall initiate a distinctive pulsing signal and cause the "Supervisory" or "PRIORITY 2 ALARM" LED to flash at the system controls so that there shall be no confusion between valve activation and opens and/or grounds on fire alarm initiation wiring. All sprinkler valve alarms shall be individually displayed at the CPU and recorded with the time and date on the printer. Both the initiation and restoration to normal shall be automatically stored in the panel history log.

F. The resetting or return to normal condition of any "PRIORITY 1" or "PRIORITY 2" device shall reinitiate the flashing of the appropriate "PRIORITY" LED for manual acknowledgment. All reset operations shall be recorded with the time and date on the system printer and in the panel history log.

G. All operation subsequent to automatic or manual activations of all system functions shall occur within a maximum time of four (4) seconds regardless of system size.

2.3 SEQUENCE OF OPERATION

A. Operation of any manual fire alarm station or smoke detector shall automatically:

1. Sound an audible alarm signal at the Fire Alarm Control Panel (FACP). The audible signal shall be capable of being silenced during the alarm condition.
2. Light the general alarm LED (red) at the Fire Alarm Control Panel. The general alarm LED shall remain lit until the system is fully reset.
3. The LED display shall provide device type, type of alarm, and alarm location message.
4. Indicate the active zone on the building Annunciator.
5. All audible alarm signals to sound and all visual alarm signals to flash continuously. Operation of the alarm acknowledge switch at the FACP shall permit the silencing of the audible alarm signals. The silencing of the alarm signal shall not prevent the resounding of the alarm devices should a subsequent alarm condition occur.

6. Operate control to initiate the transmission of an alarm indication to a central station agency acceptable to the local code authority and/or fire department. Selection of a central station agency, its equipment, its fees and fees for telephone lines and connections are the responsibility of the Building Owner.
7. Operate relay contacts to signal the Building Automation System.
8. Operate relay contacts to release electrically held doors.
9. Operate relay contacts to unlock normally locked doors in the path of egress.

2.4 AUTOMATIC VOICE EVACUATION SEQUENCE

A. The audio alarm signal shall consist of a "Slow Whoop" alarm tone for a maximum of 15 seconds followed by automatic pre-selected voice evacuation message, the "Slow Whoop" alarm tone shall resume. The alarm tones and message shall sound alternately until the signal silence switch at the CPU has been operated.

B. All audio alarm operations (speaker circuit selection and alarm tone/voice message timing variations) shall be activated by the system software so that any required future changes to the evacuation sequence can be facilitated by authorized personnel without any component rewiring. See drawings for circuit requirements.

2.5 MANUAL VOICE PAGING SEQUENCE

A. The system shall be configured to allow selective voice paging. Upon activation of any speaker manual control switch, the "Slow Whoop" alarm tone shall be sounded over all speakers in that group.

B. If any speaker manual control switches are activated, the alarm tone or message is interrupted and the control panel operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers. When the microphone button is released, the alarm tone shall resume.

C. Facility for total building evacuation and paging shall be provided to allow for activation of speakers. This shall be accomplished by the means of an "All Call "switch.

2.6 CENTRAL PROCESSING UNIT (CPU)

A. The CPU shall be housed in a semi-flush wall mounted cabinet with sufficient capacity to allow maximum system expansion and to house the alphanumeric display and printer, audio system microphone, and automatic message device.

B. CPU electronics shall be microprocessor-based. Basic Life Safety software shall be retained in erasable programmable Read-Only-Memory, EPROM, and executed from a random-access-memory (RAM) to allow password protected field editing. The CPU shall have a minimum capacity of 2,500 monitor points, exclusive of trouble points dedicated to system supervision, and 1,000 control points.

C. The system shall be a token ring network. Each node shall be expandable and shall be capable of independent fire alarm and voice evacuation.

D. Communications between CPU and nodes shall operate at 57.6k baud. Each channel shall be capable of communicating at distances of up to 10,000 ft. without the use of a line repeater.

2.7 SYSTEM TRANSPONDERS

A. Basic Transponders (BT) shall be microprocessor-based, housed in an all metal cabinet suitable for wall mounting, either semi-flush or surface. Basic transponder size shall be a combination of eight alarm points and four optional control points. Each transponder's microprocessor, memory, and associated circuitry shall have the ability to detect losses of communication with the CPU, e.g. resulting from defects in the communications circuit wiring. In this event, the microprocessor may revert to an "off-line" mode of operation and have the ability to activate any or all of the BT's control points as a result of an alarm condition from the BT's first four monitor points.

B. The Fire Alarm Basic Transponder (FABT), shall be utilized when direct connection of 2 wire photoelectric and ionization detectors, and/or 24VDC polarized signal circuits is desired. The FABT shall supervise the detector and signaling circuits in accordance with NFPA 72A Class "B" (2 wire) requirements. FABT shall be a combination of alarm monitor points, control points, supervised signaling circuits, and 1 detector reset point. The FABT shall respond to signal silence and detector reset commands manually initiated at the CPU operator's panel. The FABT may be used to supervise and operating signal circuits used for security.

C. The Voice/Phone Basic Transponder (VPBT), shall be utilized when direct connection of 2 wire photoelectric and ionization detectors, and/or speaker circuits is desired. The VPBT shall supervise the detector and signaling circuits in accordance with NFPA 72A Class "B" (3 wire) requirements. An additional module shall be available for detection and signaling circuits. VPBT shall be a combination of alarm monitor points, control points, supervised signaling circuits, and 1 detector reset point. The VPBT shall respond to signal silence and detector reset commands manually initiated at the CPU operator's panel. The VPBT may be used to supervise and operate signal circuits used for security. The BT, FABT and VPBT shall have the capability of operating from the CPU using 4 wires for digital communication in the event of a single break. The BT, FABT and UPBT shall be equipped with an internal 24VDC power supply. This supply shall be used to power 4 wire smoke detectors, signals, door holders, other types of peripherals as required, as well as other BT's and FABT's.

D. The Expanded Transponder shall be utilized in locations where a large number of monitor and/or control points are needed. The ET provides an 8-place mother board which can hold a variety of plug in cards. (BT, FABT, VPBT and control boards). It shall be configured to house 64 monitor or 32 control or a combination of monitor and control points.

1. It shall be possible for the ET to be provided with "local mode" operation should it fail to communicate with the CPU. It shall have the capability to activate any or all of its control points from any of its monitor points.

E. The communicating device transponder (CDT) shall be COMNET connected, individually addressed, and shall contain all electronics for monitoring, supervising, powering, controlling and annunciating addressed MAPNET connected devices. All COMNET addressing shall be field programmable without the use of any special tools. The CDT shall be capable of monitoring 128 individual devices on a single pair of MAPNET lines.

1. Provide addressable automatic detector mounting bases. These mounting bases shall accept pluggable heat, ionization or photoelectric smoke detector heads and shall report a trouble condition when the pluggable head is removed.

2. Zone Addressable Modules (ZAMs) shall be suitable for either flush or surface mounting. Monitor ZAMs shall provide supervised monitor circuits capable of reporting status changes and/or trouble conditions. Signal ZAMs shall provide supervised signal circuits capable of activating audio and visual alarm signaling devices and reporting trouble conditions. Each signal ZAM circuit shall be individually fused at 2 amperes. Control ZAMs shall provide all auxiliary remote control operations. Each Control Zam shall provide double pole/double throw contacts and each contact shall be individually fused at 2 amperes.
3. Serial Led Annunciators shall be capable of indicating alarm, trouble or status of any system operation or condition. Each unit shall be suitable for mounting in a standard size 6 gang electrical box. Each unit will provide annunciation and control over a single pair of Mapnet lines. Status Command Unit (SCU) shall provide 16 LED's capable of annunciating alarm, trouble or on/off status conditions. Each Led color can be changed to red, yellow or green. Remote Control Unit (RCU) shall provide 8 LED's capable of annunciating alarm, trouble or on/off status conditions. Each Led color can provide a common trouble indication, Power On Led, audible sounder and (4) programmable switches. Operation of the switches shall be key enable to protect unauthorized use.

2.8 MANUAL STATIONS

A. Provide addressable manual pull stations as shown on the plans. The station body shall be so constructed that chips and scratches will not expose metal. All stations shall be master keyed with the control equipment. When actuated, the "pull lever" shall remain at a right angle to the station body until reset.

2.9 PHOTOELECTRIC SMOKE DETECTORS

A. Provide photoelectric smoke detector heads with addressable bases as shown on the plans. Detectors shall be of the solid state photoelectric type utilizing a stable LED light source and a silicone photo diode as the receiving element to form a highly accurate means of smoke detection. Internal detector circuits shall be shielded against electrical interference and resistant to transients, noise, and RF interference. Detector shall be low profile. Detector shall have a red LED that comes on steady to show that the device is in alarm. Detector shall compensate for environment changes and sensitivity shall be field selectable from .5% obscuration to 3.7% obscuration.

B. Regardless of sensitivity settings, the detector's stability shall be unaffected by high air velocity. Control Panel shall be able to provide average and peak readings of each detector to assure maximum sensitivity.

2.10 ALARM SIGNALS

A. Provide ADA approved audible/visual strobe units as shown on the plans. These units shall mount to a standard four inch square outlet box. A complete unit shall also include a speaker. The strobe light shall have a white lens with red "FIRE" imprinted on it and shall have a xenon flasher and a flash rate of 1 Hz to 3 Hz. Candela ratings shall be as required for proper coverage in accordance with sub-contractor's calculations. The speaker shall be red in color, have 1/4, 1/2, 1, and 2 watt tap settings and shall provide at least 82 db at 10 feet when set at a one watt tap as measured.

2.11 DUCT DETECTORS

A. Provide addressable duct detectors with environmental compensated photoelectric detector heads and sampling tubes as shown on the plans. Duct detectors shall be installed under Division 23 and electrically connected to the fire alarm system under Division 26. Each detector to have an integral relay and be capable of operating a remote LED to indicate its alarm condition. Detectors zoned with other devices shall be capable of operating their integral relay even if all other devices on their circuit have gone into alarm.

2.12 SPRINKLER FLOW SWITCHES

A. Flow switches and valve tamper switches are furnished and installed by Division 23 and wired under Division 26. Provide addressable monitor interface.

B. Provide Zone addressable modules to monitor each water flow device and tamper switch.

2.13 DOOR HOLDERS

A. Provide Zone addressable modules for each door holder specified in the hardware specifications to interface with the control panel.

2.14 REMOTE RELAYS

A. Provide individually controlled and supervised relays, mounted in metal enclosure, as shown on plans. Relays shall have twenty-four volt DC coils and their contacts shall be rated at ten amps 120VAC. Each relay shall have a red LED mounted on its cover to indicate if that relay has been activated.

B. Provide relays at each fire door as specified in Division 08 and interface with fire alarm system to release doors in an alarm condition.

2.15 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers are Honeywell (Notifier, Gamewell FCI), Tyco (Simplex), GE (Edwards), and Siemens (Pyrotronics).

PART 3 - EXECUTION

3.1 INSTALLATION

A. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagrams. Provide conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. Wiring shall be of the type recommended by the manufacturer, approved by the local authority having jurisdiction and shall be installed in dedicated conduit throughout.

B. Wiring must meet the survivability requirements of NFPA 72, Chapters 12 and 24.

C. Wiring shall be color coded throughout, to National Electrical Code standards.

D. Field Quality Control: The system shall be installed and fully tested under the supervision of a trained manufacturer's representative. The system shall be demonstrated to perform all the functions as specified.

E. Where remote power supplies are required, Contractor shall provide power from local branch circuit. Fire alarm sub-contractor and electrical sub-contractor shall coordinate requirements as needed, without an addition to the Contract.

3.2 TESTS

A. Reports of any field testing during installation shall be forwarded to Project Engineer.

B. Each individual system operation, on an address by address and circuit by circuit basis, shall be tested for its complete operation. Procedure for testing the entire fire alarm system shall be set forth with the consent of the code enforcement official, the Project Engineer and the manufacturer. Use NFPA 72 2-2 documentation.

3.3 DOCUMENTATION AND TRAINING

A. As a part of the operation and maintenance manuals, provide data to include operating and maintenance instructions, catalog cuts of all equipment and components, all as-builts wiring diagrams (both floor plan and riser types) and a manufacturer's suggested spare parts list.

B. In addition to the above manuals, the Contractor shall provide the services of trained manufacturer's representative for a period of four (4) hours to instruct the Owner on the operation and maintenance of the entire system.

3.4 PRICING NOTE

A. Provide unit pricing for the addition of each of the following devices, as potentially requested by fire marshal during final inspection:

1. Horn/strobe device.
2. Strobe only visual device.
3. Speaker/strobe device.
4. Smoke detector.
5. Heat detector.

B. Unit pricing shall include work of all trades involved (electrical, drywall, paint, etc, as applicable).

END OF SECTION 283100

SECTION 313116 - TERMITE CONTROL

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. Section includes:

1. Soil treatment with termiticide.

1.3 ACTION SUBMITTALS

A. Product Data: For termiticide.

1. Include the EPA-Registered Label for termiticide products.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For termite control products, signed by product manufacturer.

B. Qualification Data: For Installer of termite control products.

C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

D. Warranty: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located and who employs workers trained and approved by manufacturer to install manufacturer’s products.

B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products from a single manufacturer for each product.

1.6 PROJECT CONDITIONS

A. 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.

B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.7 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

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, provide products by one of the following:

a. BASF Corporation, Agricultural Products; Termidor.
b. Bayer Corporation; Premise Pre-Construction.
c. FMC Corporation, Agricultural Products Group; Talstar, Prevail, or Dragnet FT.

2. Service Life of Treatment: Soil treatment termicide 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, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.

1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all 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, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-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: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Masonry: Treat voids.

4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116